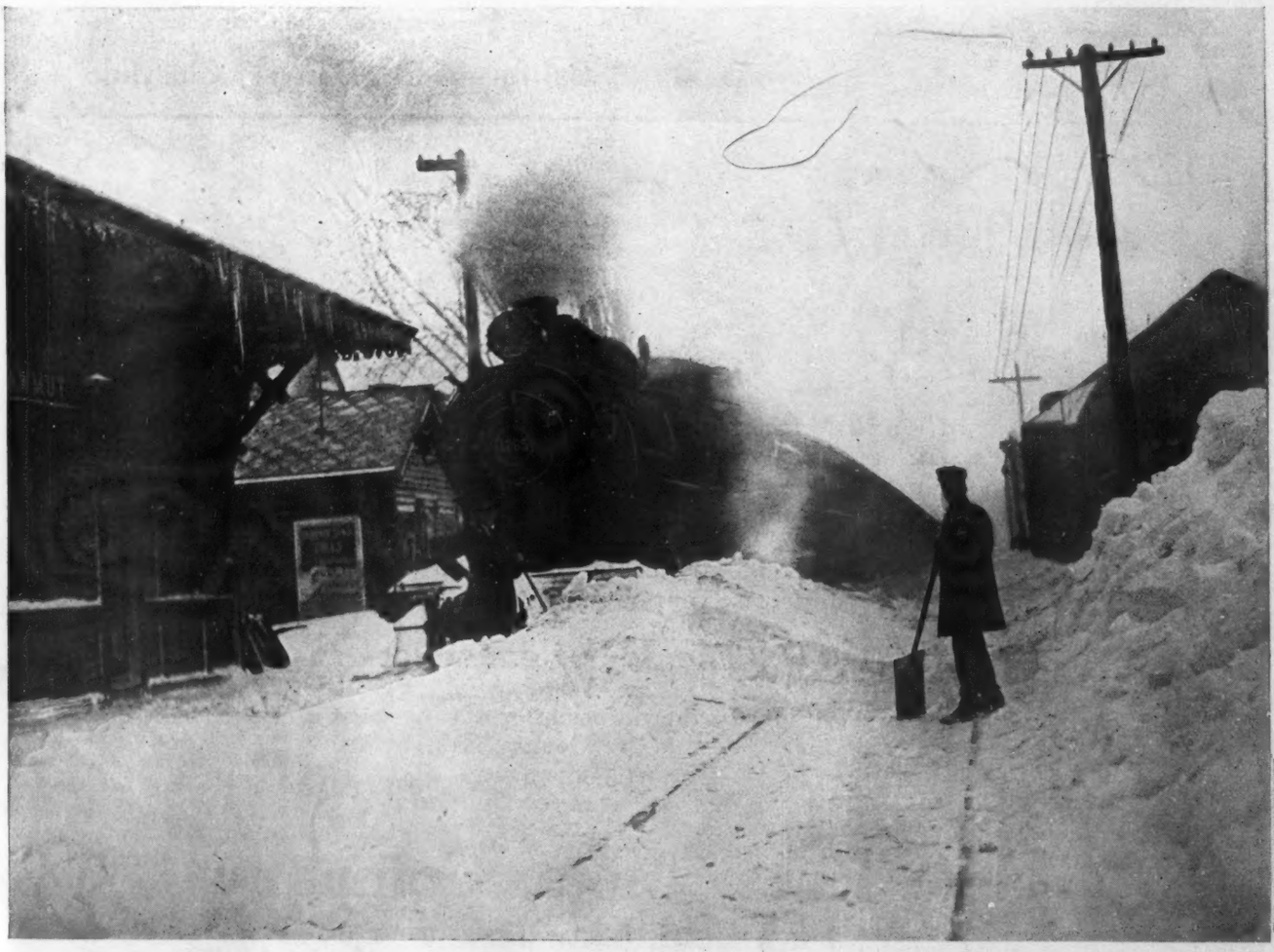
COMPRESSED AIR MAGAZINE

25c THE COPY

$3 THE YEAR

New York and London

Vol. XXV APRIL, 1920 No. IV



Copyright Underwood & Underwood.

CLEARING AWAY A BAD SECTION IN A FEBRUARY SNOW STORM ON THE N. Y., N. H. & H. R. R. TIE TAMPERS WERE USED TO REMOVE ICE FROM SWITCH POINTS AND CROSS OVERS

TABLE OF CONTENTS, PAGE 9628—ADVERTISERS' INDEX, PAGE 9634, READERS' GUIDE, PAGE

Compressed Air Magazine

A digest of compressed air and pneumatic practice, and also of engineering and industrial data germane to allied mechanical arts

Compressed Air Magazine Company, Publishers

New York London Easton, Pa.

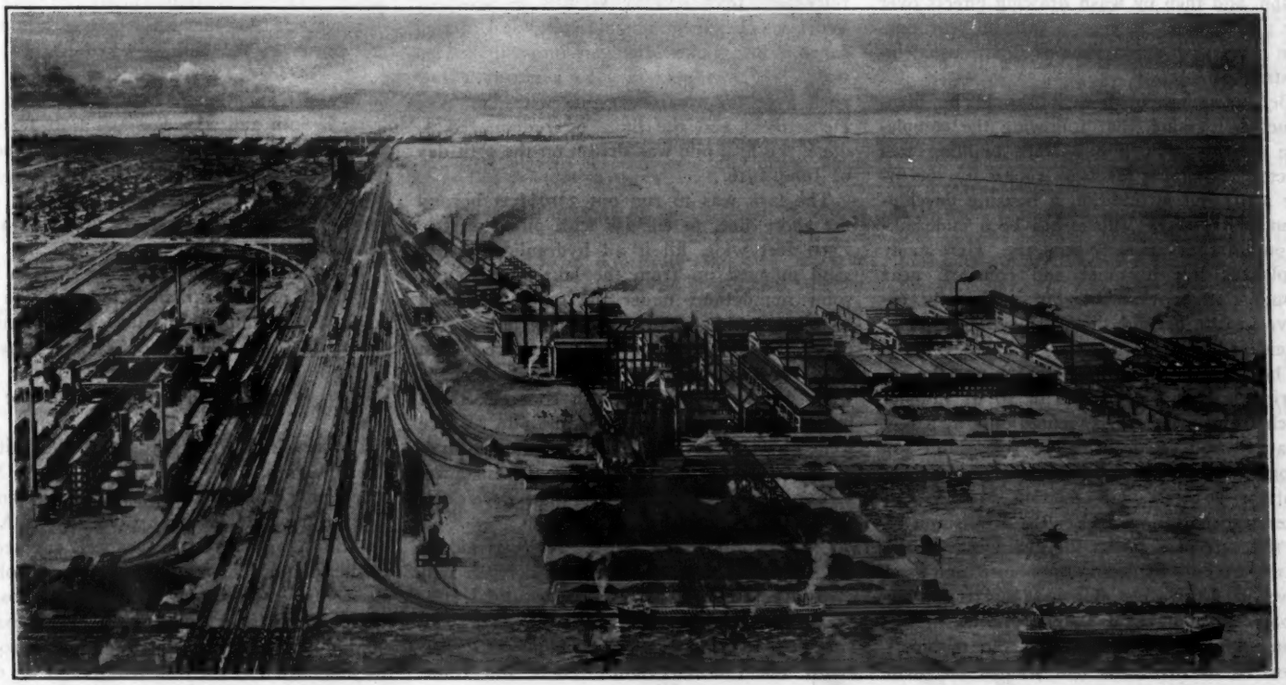
Editorial and Business Offices: Bowling Green Building, No. 11, Broadway, New York City, U. S. A.

25c the copy $3 the year, U. S. A. and Mexico $3.50 foreign

VOL. XXV, NO. III *Contents Copyrighted* APRIL, 1920

The World's Most Modern Pipe Plant

A Twentieth Century Wonder Worked in the Erection of the Mark Mills of the Steel & Tube Co. of America at Indiana Harbor, over Sand and Water



*Birds-eye view of the completed Mark plant of the Steel and Tube Co. of America at Indiana Harbor, East Chicago. This picture is a composite photograph and wash drawing, the view having been obtained from a captive balloon. This picture gives an idea of the enormous task accomplished by the construction engineers in eighteen months, lacking four days.**

By FRANCIS JUDSON TIETSORT

THE STORY of the erection of the Mark plant of the Steel & Tube Co. of America on the unstable sands of Indiana Harbor on the southwest shore of Lake Michigan, 25 miles from Chicago, recalls the struggle of the construction engineers at the American International Shipbuilding Corporation's Shipyard at Hog Island, although these two great jobs were scarcely analagous. Both were carried through successfully, however, by engineering faith in the face of great difficulties. The details of the Indiana Harbor project read like a romance. A sandy bottom under from fourteen to 25 feet of the boisterous waters of Lake Michigan was reclaimed by the competent engineers and the army of men that toiled with them, and sixteen feet above high water was reared the finest and most modern steel and pipe plant in the world.

THE erection of the Mark Plant of the Steel & Tube Company of America at Indiana Harbor marks a chapter in the field of modern structural engineering which will furnish a precedent for the construction of other plants under similar conditions of unstable water bearing ground situated under water and exposed to the action of wind and tide.

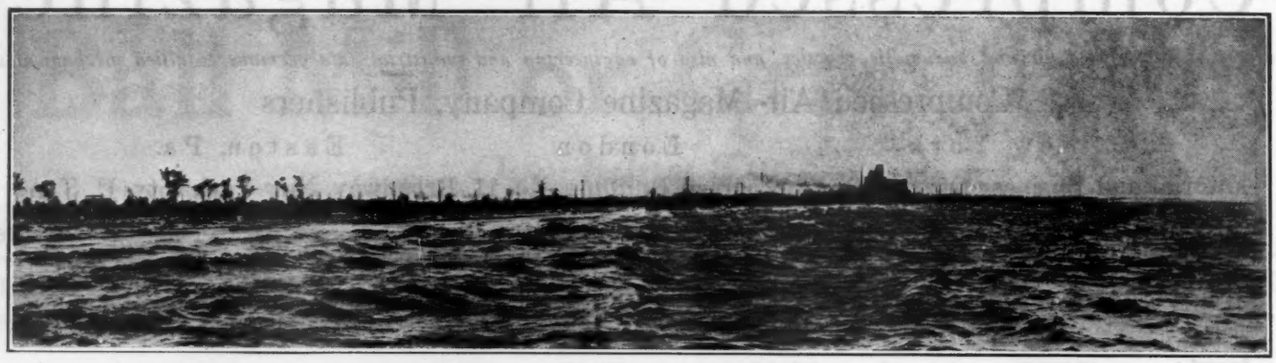
The efficiency of steel encased concrete piling was amply demonstrated as a practicable addition to the standard engineering methods of supporting a structure on a foundation consisting of the sandy bottom of Indiana Harbor.

The construction of a steel plant capable of taking in iron ore reducing it by the various processes and treatments necessary to convert it into the highest grade of steel and finally manufacturing it into 20 in. wrought steel pipe, under these untoward conditions described in the foregoing, is a notable achievement even in a modern era of engineering feats.

One may give the Egyptians of the Ptolomies or Rameses periods credit for good jobs in temple and pyramid building on desert sands and one may also consider that in India, probably many years before the time of Confucius of neighboring China, the engineers even used compressed and heated air in crude apparatus to raise blocks of stone in the rearing of their temples, but at the same time these ancient wonders are scarcely comparable to the Indiana Harbor achievement!

The photographic mental impressions one re-

*Photographs by Robert Harry Hall, Chicago, for Compressed Air Magazine Illustration Service.



Indiana harbor shore line and water front side of Mark Manufacturing Co.'s plant before the big job was begun. Here a hydraulic fill of 30 feet was made, 2,000 feet wide and 3,379 feet out into the waters of Lake Michigan.

ceives at the plant are reflected better really in the pictures accompanying this article, than they can be in the printed word. The bird's-eye view of the plant which is presented, was made from a captive balloon, first by photograph, and then by wash drawing effects over the photograph. It gives a faithful reproduction of general appearance of this unusual industrial community.

Before going further, it should be mentioned in passing, that following the completion of the mills, a fine office building was erected, containing luncheon rooms for the office staff, and in addition a housing development called Mark Village has been undertaken on adjacent company property. Here many employees live in quiet and comfort, near enough for convenience, but sufficiently removed to be beyond the working atmosphere in leisure hours.

The first step at Indiana Harbor was the acquiring of a hundred acres or so of Indiana beach-front property frequented only by a few squatters and sea gulls. The sole claim for recognition of this site, of course, was its strategic position with relation to rail and water transportation. After the acquisition of the site, one may gather the nebulous state of the undertaking by noting the photograph used above in illustrating this article. It was a gloomy waste of wild water over which the engineering talent gazed when the optimists in search of dividends had wished on them the task of carrying out the project.

The construction engineers were of course accorded a free hand, with sufficient capital, together with a little something in the way of riparian rights. They thereupon proceeded, working sixteen hours a day, as executives on the job, for eighteen months, and put the Mark plant in operation delivering its product.

The preceding introductory remarks have been set down to indicate that the task at Indiana Harbor has been a simpler matter in retrospect than it ever seemed in prospect. Work was begun on unstable sand and carried far out into Lake Michigan into fairly deep water. It was necessary to perform a few rites over the riparian rights with the War Department and the State of Indiana. This done, the first pile was driven on the 27th day of June, 1916.

The task was to run out 3379 feet beyond the shore line, to enclose with piling a strip 2,000 feet wide, fill it all hydraulically with sand pumped up from the lake, and so put solid foundations under the great steel and concrete buildings necessary to house the plant. In the water, wooden piles were driven from floating drivers. Ashore, steel shells were driven, then filled with concrete, there being a loading of 30 tons to the pile. These went down an average of 30 ft. into the sand, being supported by the frictional resistance. Underneath the blast furnaces piles were driven down 70 feet to clay or hardpan.

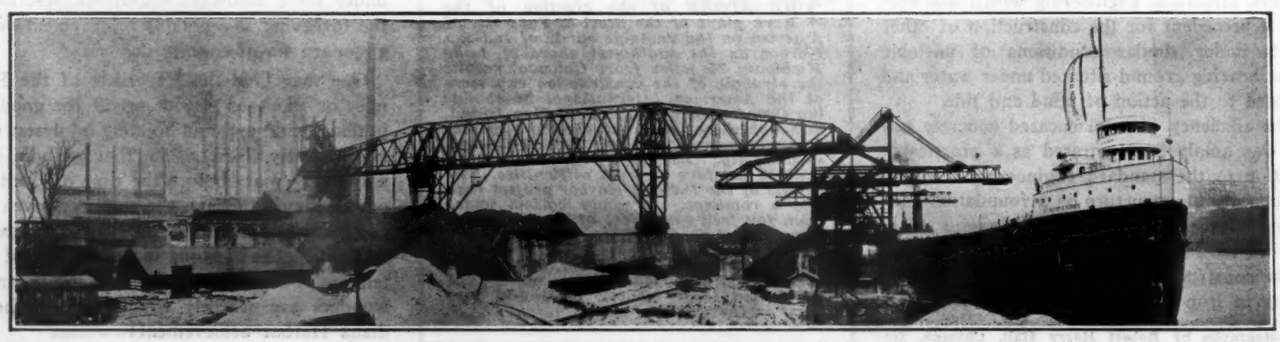
Construction engineers were really afraid of big seas and high water. Lake Michigan will sometimes have a freakish, almost tidal rise, of four feet. On the other hand the waters have been known to lower to a point six inches below the Chicago Dam. There did come along one storm that washed out part of the work, but this temporary set back did not discourage the engineers. They redoubled their efforts, made good their repairs and pressed forward. On the lake fill, which amounted to a total of 30 feet, fourteen feet on the average, below the lake level and sixteen feet above it, it was figured by the engineers that the sustaining power of a pile by friction would be at the rate of two tons to each square foot of surface, which was considered to be ample. This estimate has proven to have been conservative, for there has been absolutely no settlement of the buildings.

Ore is loaded from the company's own sources of supply from Ashland, Two Harbors, Duluth and Superior and transported to Indiana Harbor. All through the eight months of navigation on the Great Lakes, from three to four steamships a week, carrying from 8,000 to 12,000 tons each, are unloaded at the plant docks.

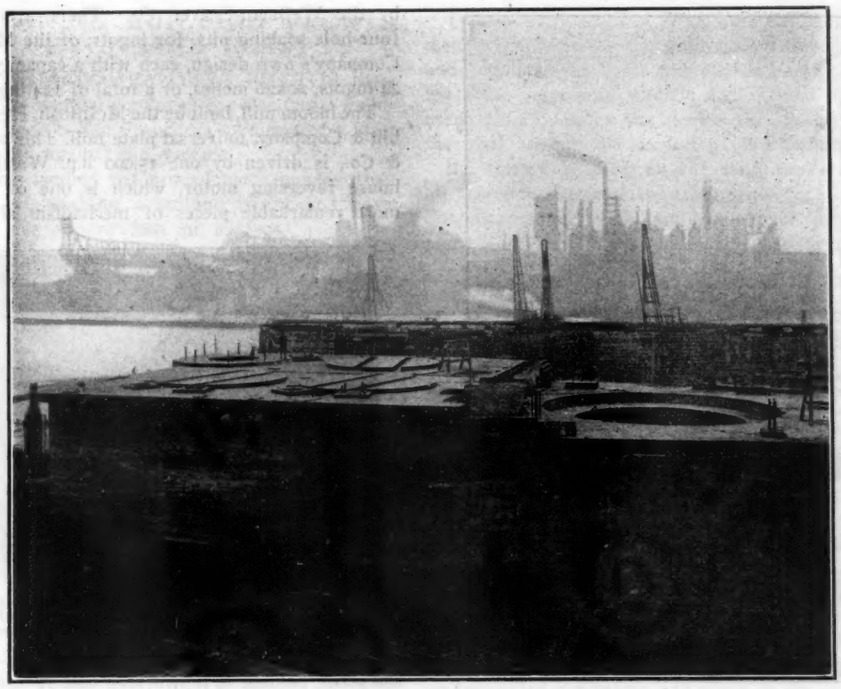
The plant is connected by the Indiana Harbor Belt Line with all the big trunk line railroads and is admirably situated for transportation facilities. This, of course, was the compelling reason for selecting a site at a spot so little favored by nature for the purpose.

The result has fully justified the faith of the officers and directors of the Mark Manufacturing Company, which later became a part of the Steel & Tube Company of America—and has backed up expert engineering prediction and opinion. The lay-out of the plant, the choosing of the highest possible grade of machinery equipment, the plans for routing materials through the entire process, the adaptation of the best features of all other successful plants, all made for a high degree of perfection in result.

The Mark plant makes everything in wrought steel pipe from two inches to 20 inches in diameter of the standard length of 22 feet. The story following in the train of



Unloaders, ore bridge and ore pockets of the Mark plant, showing typical lake ore carrier with great deck space for hatches, pilot house being far forward and engines aft. There is a depth of 25 feet of water at the docks. These vessels usually draw a little more than 22 feet of water when fully loaded.



Solid concrete foundation for the blast furnace. Steel encased concrete piles were driven down 70 feet through sand to hard pan as the first step in this foundation work.

the successful building of this plant by the Mark Manufacturing Co. is that the company consolidated with the Iroquois Iron Works, its neighbor in South Chicago, in July, 1917, forming the Steel & Tube Company of America.

Originally the Mark Manufacturing Company consisted of a pipe finishing plant at Evanston, Ill., and Zanesville, Ohio. The company owned also a zinc mining operation at Plattsville, Ill., called the Vinegar Hill Zinc Company. In those days the company was a purchaser of skelp in the open market.

The idea was conceived of going into steel "on its own" in order to insure a stable supply for its pipe mills. A site was found at Indiana Harbor on a tract bought by the late Henry Frick, and where he had wished to build. Two blocks of 46 acres each were obtained on the Pennsylvania Railroad and nearby ship canal. The present plant is located on one of the 46 acre blocks and upon the 200 acres of made land, the other block of 46 acres being in reserve.

In September, 1918, an ore supply was added to the combination through the Newport Iron Mining Company and others, along with two blast furnaces at Mayville, Wis., and the coke plant at Indiana Harbor of the By-Products Coke Corporation. All of the foregoing were merged into one cohesive coördinated organization as the Steel & Tube Company of America.

The result is an efficient, smooth-running organization, thanks in no small degree to the engineering pluck which erected a model pipe mill where once high combers used to sweep in for three-fifths of a mile until they thundered on the sandy beach.

There are two big steel unloaders at the company's Indiana Harbor docks, where the steamers have 25 feet of water, each with a capacity of 80 tons an hour. The unloaders and ore bridge beyond were designed and built by Hoover & Mason, who also designed and put in the ore and coke pockets. Freyn, Brassert & Co., a Chicago engineering firm, designed the blast furnace built by the Pennsylvania Engineering Company of New Castle, Pa. This furnace is set in solid concrete.

The entire equipment of the plant, only the main features of which can be mentioned in this article, is noteworthy. There are at present twelve boilers of 600 horsepower each, with single settings and individual stacks. Six were built by Casey & Hedges, Chattanooga, and there are six Sterling boilers built by Babcock & Wilcox. The company is about to install six additional boilers, which will make a total battery of eighteen.

In the power house are two Westinghouse generators of 12,500 kva capacity each, and two of 6,250 kva each.

Here are installed also two Ingersoll-Rand turbo blowers, each with a displacement of 55,000 cubic feet of air per minute, one of which is a spare. This air is heated and supplied to the vertical hot-blast furnace for the reduction of the ore in its contact with the coke and flux.

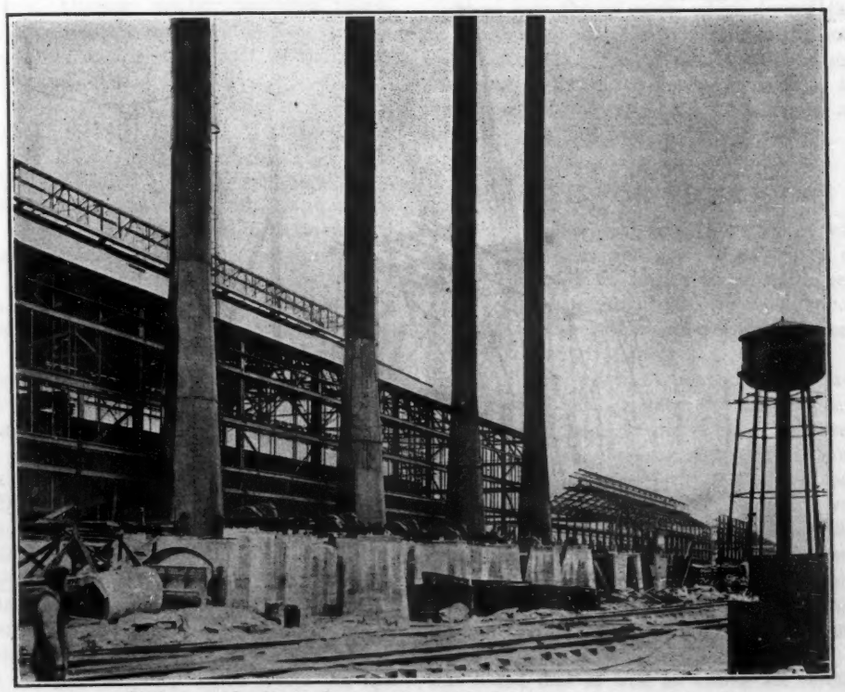
In the basement of the power house is installed an Imperial type X B 2 Ingersoll-Rand compressor, 16x10x14. Two other Imperial type Ingersoll-Rand compressors are installed elsewhere in the plant, each being belt-driven from motor. These compressors provide all the air for chipping hammers in the billet mill and for the Little David hammers, drills and other pneumatic equipment required throughout the works.

All of the water service pumps in the plant were provided by the A. S. Cameron Steam Pump Works. The water of Lake Michigan is brought into the power house by a conduit and is pumped through the plant from this central station. Condensers are set in this conduit and pump their own water for the vacuum.

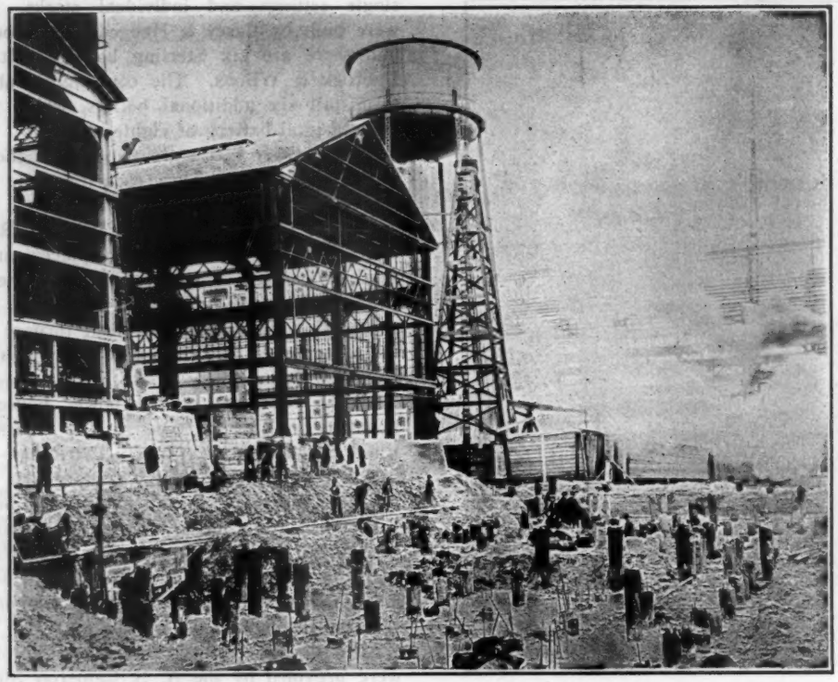
The Cameron equipment comprises:

Four 16 DV pumps, two being turbine driven and two motor driven. These have a capacity each of 7,700 gallons per minute on a head of 140 feet, and are used as general service pumps on mill supply.

One motor-driven hydraulic pumping unit, consisting of two No. 3 four-stage pumps in series, which operate the manipulators on the



Construction work on gas producers for the Mark plant



In the foreground will be seen some of the concrete piling. These piles were driven in steel casings, the average load being 30 tons. These piles have a frictional resistance against weight they sustain of two tons to the square foot.

billet mill. Their capacity is 225 gallons per minute on 500-pound pressure. A duplicate of this unit is on order.

Two No. 6 three-stage boiler feed pumps, both turbine driven, of 700 gallons per minute capacity on 235-pound pressure.

Two No. 10 DV motor-driven booster pumps, used on gas washer, each having a capacity of 2,000 gallons per minute at 35-pound pressure.

Two No. 8 DV motor driven pumps on hot well service, each having 1,200 gallons per minute capacity on 60-foot head.

Four No. 12 DV motor driven pumps of 3,500 gallons per minute capacity on 140-foot head.

The blast furnace at the Mark plant is designated as a 550-ton furnace.

There are four 75-ton basic open-hearth furnaces, which the company built itself.

Of the gas producers at the plant, six were built by the Morgan Engineering Co. and 22 by the Wellman-Seaver Co. There are six four-hole soaking pits, for ingots, of the Mark Company's own design, each with a capacity of 24 ingots, 20x20 inches, or a total of 144 ingots.

The bloom mill, built by the McIntosh, Hemphill & Company, universal plate mill. This plate & Co., is driven by one 15,000 h.p. Westinghouse reversing motor, which is one of the most remiarkable pieces of mechanism about

Showing how pipe is cut into standard 22-foot lengths by circular steel saws revolving at great speed. Beyond is the store house, where pipe is stored before being shipped on order to the oil fields.

the plant, coming to a full stop and reversing itself in a few seconds. This bloom mill manufactures the necessary billets, blooms and slabs required for a ten-inch Morgan continuous skelp mill and a 30x43-inch McIntosh, mill is driven by an 8,000 horsepower Westinghouse reversing motor.

Directly ahead of the bloom mill is a 28-inch two-high reversing billet mill driven by a 5,000 horsepower Westinghouse reversing motor.

There are three lap-pipe mills; one 2 to 4-inch lap pipe; one 4 to 8-inch lap; and one 10 to 20-inch lap with the necessary finishing capacity for threading and testing.

There are 120 by-product coke ovens built by the Sement-Solvay By-Product Coke Corporation of Syracuse, N. Y., fully equipped to make

The red hot pipe is brought by conveyers to these water-cooled rollers, between which it revolves that its shape may be rectified and made uniform.

all standard by-products. This has a capacity of 48,000 tons of blast furnace coke per month. About 14,000,000 cubic feet of coke oven gas is burned daily at the plant.

Showing concrete and steel construction work on the big ore bridge

---

According to reports received in New York from Bolivia, a law taxing mining profits has passed congress. The measure has been sent to the President for proclamation.

CLEANING BUILDING FRONTS BY A SAND BLAST

THE ACCOMPANYING PHOTOS show the method employed for cleaning a building front in San Francisco, by directing a blast of sand against the surface.

This method has proved much quicker than that of washing a building front and costs less per square foot of surface.

Fig. 1 shows the compressor, air tank and electric motor for operating the compressor,

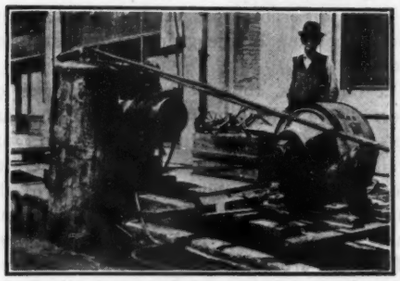


Fig. 1—Showing the Compressor, the air tank and electric motor

which are usually placed in the basement, but in this instance they were placed on the sidewalk. Fig. 2 shows the sand receptacle. This consists of a metal tank with an opening in the top through which the sand is introduced. The sand is first placed in a special scoop, on the top of the tank. From this scoop, which acts as a measuring device, the sand is introduced into the tank, the opening is then closed, and the compressed air introduced into the tank. This compressed air forces the sand into the hose, leading to the front of the building, where a special device is attached which directs the sand under air pressure against the surface of the building. There is a by-pass at the sand receptacle, where compressed air direct from the main air tank is introduced into the hose, leading to the special device previously mentioned. Here

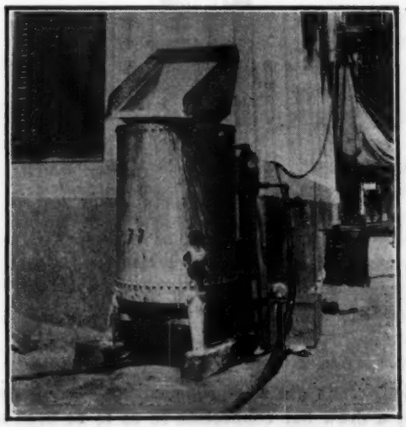


Fig. 2—Sand receptacle with measuring scoop. By-pass and mixer at right of tank

the sand and air can be mixed in the proper proportions. A small amount of sand and a large amount of compressed air may be directed into the hose, or a small amount of air and a large amount of sand may be directed, or may be graduated to suit conditions.

Two men are required to operate the equipment. One man fills the sand tank with sand, and regulates the sand and air, and watches the compressor and electric motor, and the other man operates the device for directing the blast against the surface of the building.

By closing a valve on the sand tank the air may be diverted to other uses such as operating an air drill, air hammer or other pneumatic devices.

EXPLOSIVES SENSITIVE TO FRICTIONAL IMPACT

By S. P. HOWELL

Many commercial explosives may be exploded by severe and prolonged friction, some being more sensitive than others in this regard. Explosives containing potassium chlorate are especially likely to explode under such conditions. Tests to determine sensitivity to frictional impact having previously been made by unsatisfactory equipment, a pendulum friction device, described in Technical Paper 234, Bureau of Mines, that permits uniformity of execution, was designed and built. The results of tests with this device on a large number of explosives and under varied conditions are given in the publication noted above. They indicate that the tests are not too severe, since potassium chlorate explosives which failed to pass the test exploded prematurely in commercial use; all explosives of this type being extremely sensitive to frictional impact. Those potassium chlorate explosives that passed the tests were rendered sufficiently insensitive to friction by adding an adequate quantity of mineral oil, vegetable oils, and aromatic nitro compounds, or by reducing the potassium chlorate to a small percentage. The sensitiveness of such explosives to friction is greatly increased by the presence of pyrite-bearing coal. Black blasting and ignition powders, blasting gelatin, ammonia dynamites, and organic nitrate explosives are not as sensitive to friction impact as the nitroglycerin and gelatin dynamites.

COMPRESSED AIR USED ON SHELL OIL CO. BARGES

THE SHELL OIL COMPANY operates a fleet of four oil barges on San Francisco bay, for delivering bunker oil to steamers, and storage stations maintained by the company at San Francisco and Oakland.

Each barge is equipped with an oil burning boiler, for generating the steam which operates the cargo pumps. At stated times, the boilers are cleaned, and for the purpose of raising steam in the cold boiler, each barge is equipped with an air pump, and tank. The tank shown in the illustration is attached to metal supports on the deck of the barge, and is filled with distillate. Air pressure is then raised in the tank to about 50 pounds. This pressure forces the distillate through the oil burner, in the form of a spray, and when lighted, produces a flame under the boiler. When steam has been raised in the boiler to a pressure of 15 or 20 pounds, the distillate is shut off, and the pump which forces the fuel oil through the burner is started up. The distillate tank holds about 50 gallons, which is more than sufficient to raise steam to a point where the oil pump may be started. As a safety precaution the distillate tanks are always placed on the outside of the pump room,

The distillate tank is shown below the window of the pump house

as shown. The fuel oil is carried in tanks below deck. The boiler room and pump house occupy one end of the barge. The crew consists of one man, who lives aboard. The barges take on their supply of fuel at Martinez where the company has a refinery, and are towed between the refinery and points on the bay by gasoline launches.

Powerful duplex pumps pump the oil from the barge tanks to the fuel oil tanks aboard steamers, while the steamers are docked or when they are in the stream.

Raising a Sunken Oil Barge

Recently an oil barge was sunk in San Francisco bay and compressed air played an important part in raising it. An air compressor was placed on another barge by the salvaging company and towed to the oil barge. A connection was then made with the pipes on the oil barge, so that compressed air could be forced into the top of the oil tanks. Another connection was then made with the oil delivery pipe leading from the bottom of the oil tanks. When all was ready compressed air was introduced into the oil tank, which forced the oil out through the pipe connected to the bottom of the tank. This oil was saved, and the empty oil tanks caused the barge to raise to the surface of the water, and the salvaging of the barge was then easy.

NEW USE FOR POISON GAS

A new use has been found for surplus war stocks of asphyxiating gas. Some cases of typhus occurred in Paris, among refugees, and it was suspected that they originated from clothes from which vermin had not been entirely removed.

One of the measures used by the Pasteur Institute was to take the clothes, hair brushes and combs of those who had been in contact with persons affected and hang them for twenty minutes in a cylinder containing a mixture of chloropicrine, which was one of the asphyxiating gases used in the war. Twenty cubic centimeters of gas were used for every cubic meter of air and the mixture was heated to 45 degrees Centigrade. In addition to clothes the mattresses and blankets were treated in this way and it was found that as well as killing all vermin the gas disinfected them completely.

Maintenance Cost Reduced by Pneumatic Tie Tampers

Produces Ideal Tamping Conditions Without Fatigue to Workman—Tamps Around Switches and Frogs Where Pick Fails—Comprsseor Unit Generally Useful for Operation of Varions Pneumatic Tools in Railroad Work

*By W. H. ARMSTRONG**
Member American Society Mechanical Engineers

THE USE of pneumatic tie tampers is of particular interest at the present moment owing to the reconstruction work being generally inaugurated by railroad companies. Rebalasting and retamping of long stretches of track are being planned in order to bring the road beds back to their former peace time standards. Much of this work was neglected in recent years because of more urgent and immediate work required in transportation of essential materials. The tie tamper proved of the greatest advantage to maintenance engineers who have appreciated its value not only as a time saving device but in providing a distinctly superior road bed to any hand tamped track.

THE incentive for the development of the pneumatic tie tamper was to produce a mechanical means of tamping crushed stone and other grades of ballast under railroad ties and thereby relieve the workmen of the most arduous duty of track maintenance. In its present state it not only fulfills the best hopes of its inventors, but produces a more uniform quality of work and an easier riding and safer track; its use results in a saving of both labor and money.

The first experiment with the machine as at present constructed was made on the New York Central Railroad in 1913. It was then realized as one of our most able maintenance engineers has stated, that "Labor is the largest single item of maintenance of way and structural expense. For normal maintenance it is as much and often more than all the other items combined as it averages from 50 to 55%. More labor is used in surfacing and lining of track than any other item of track work. Normally this will amount to about 35% of the total track payroll. This offers an attractive field for labor-saving."

Introduction of the Tie Tamper

At the time the tie tamper was first developed and put into service the problem confronting the maintenance engineers was to get the greatest performance per unit of labor,

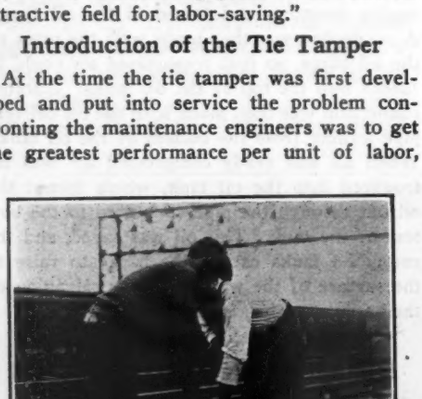


Fig. 1. Tie tamper on Central R. R. of N. J., Jersey City terminal

there being at that time a sufficient supply of labor units to meet the demand, notwithstanding the inefficiency of that available.

The tie tamper achieved an instantaneous success; the first road to use it now employs 228 of the complete outfits. The original outfit is still working, and the section foreman in whose charge it has been has repeatedly refused to have it replaced by a more modern machine, as he is proud of his association with its development.

Today we are confronted with another factor in the problem, an insufficient supply of labor, and to overcome this shortage, the resort is to be had to labor-saving devices,—machines to take the place of men. Many of these have been developed and in use for a number of years and were inspired by the desire for economy, that is, to save dollars. A new incentive for their use has been introduced, to save men.

The tie tamper was introduced into use about 1913 and consisted in a percussion hammer arranged with two handles and fitted with a tamping bar which is dressed on the face the same as the hand tamping pick or bar. It is equipped with a retainer for holding the tamping bar in the machine so that it will not drop out when being lifted from one point to another. The handles are arranged to be held in the hands of the operator so that the machine balances naturally in the correct position for tamping ties.

Operation of the Machine

The action of the machine differs from the ordinary method of tamping in that the tamping bar remains in contact with the ballast while in operation instead of being lifted up and down as in the case of hand tamping. The machine is held in a vertical position at the start, with the tamping bar resting on the ballast and parallel to the tie as shown in illustration, Fig. 1. Due to rapid percussion blows of the piston, on the shank end of bar, Fig. 2, it will work down through the ballast (which should first be loosened with a pick) until it reaches the bottom of the tie when the machine is swung in the correct position to pack the ballast to the center of the tie.

Three different types of tamping bars are used according to the grade of ballast being tamped.

In terminals, tunnels and other places on the railroad, where pneumatic signal lines are installed, or where permanent air lines are available, the tie tampers can be operated from these lines without the necessity of the auxiliary compressor unit. For use on signal lines a special valve is provided which cuts off the air from the machine when the pressure drops to the minimum required for safety.

Tamps Any Kind of Ballast

For supplying air at points where a permanent source of air supply is not provided, a portable gasoline driven compressor unit has been developed, which is mounted on a suitable car and is self-propelled so that it will run under its own power to the location where work is to be performed and there set off to one side of the track. This portable compressor is made in two sizes, one for operating two tampers and the other for operating four tampers, Fig. 3.

For street railway work where electric current is available a portable compressor unit electric driven from an electric motor is

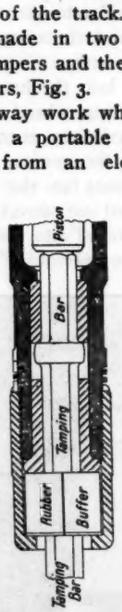


Fig. 2. Tie tamper in cross section.

used. It is not self-propelled but is arranged for a draw bar connection so as to be used as a trailer behind a street car, Fig. 4.

The use of tampers produces a more uniformly tamped track, which means an easier and smoother riding track. This is owing to the fact that the tampers work in pairs opposite each other, Fig. 5, and by reason of a uniform air pressure they strike a uniform blow. It is impossible to obtain this by hand be-

*From Railway Maintenance Engineer.

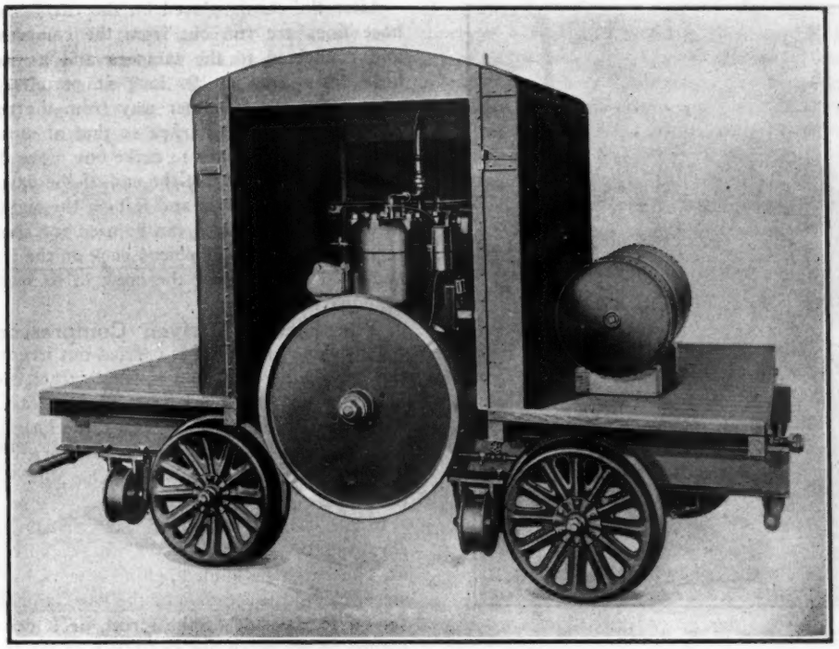


Fig. 3. Four tamper gasoline engine driven tie tamper compressor.

cause a man's physical strength is not uniform throughout a day, and furthermore, all men are not equal in physical strength.

Picks Cannot be Used

Pneumatic tie tampers tamp the ballast compactly and uniformly under the tie avoiding the formation of pockets which in wet seasons will hold water and cause a pumping tie and produce subsequent settlement. This is the result of the tampers working in pairs opposite each other and striking a uniform blow.

The tamper will tamp around and under frogs, switches, crossovers, water pans and other places impossible to reach with picks or bars, because the tamping bar can be turned parallel to the rail, Fig. 6, and inserted into any space through which the tamping bar will pass (limited only by the width of the tamping bar), then turned at right angles and parallel to the cross tie, Fig. 7, and tamp firmly to the center of the tie, Fig. 8, where it is impossible to strike a blow with a tamping bar or pick.

Shoving Action vs Crushing Action

Pneumatic tampers do not crush or scatter the ballast. This is due to the fact that a crushing blow is not struck directly on to the ballast, but a series of blows are delivered on the shank end of the tamping bar, the face of the tamping bar remaining in contact with the ballast. This produces a shoving effect and the tamping bar forces ahead of it as much ballast as it will cover and carries it to its proper place under the center of the tie. In other words, the action is a shove action. Right here is the distinctive feature of the tie tamping device which gives it a great advantage over the pick or bar. It is mechanically correct for the work it is to perform.

This feature also results in another advantage. They do not injure the ties by slivering. This is also owing to the fact that no crushing blow is delivered directly against the tie. One of our prominent American engineers in a paper recently presented before the American Wood Preservers' Convention for the Conservation of Timber made the statement: "The wearing away of the ties by ballast is the result of tamping the ballast under the tie and the action of the tamping tool striking the side and edge of the tie rather than the action of the tie bearing upon and working in the ballast under train-loads. There is but little mechanical wear due to the tie working in the ballast." It is estimated that 35% of the deterioration of railroad ties could be attributed to mis-struck blows from tamping picks or tamping bars which tended to sliver the edges off the under side of the tie, resulting in a rounded or circular bottom to the tie which was very difficult to tamp firmly enough to hold the tracks in proper grade and line. This condition is entirely eliminated by the use of the tie tamper.

Effect on Workmen and Expense

They do not tire the workman as much as hand tamping. This is because a man can stand erect, Fig. 9, instead of in a stooped position as is required by either the tamping pick or the tamping bar, Fig. 10, and also because he does not have to exert himself in handling the tamper but merely to hold it loosely and guide it as is necessary to properly tamp the tie.

They reduce the cost of track construction and maintenance, because (1) the work is done much faster than by hand tamping; (2) the result is a more uniformly tamped track which will stand up under heavy traffic over a longer period where hand tamping is done; (3) the size of the gang is reduced.

The last factor is illustrated by the fact that two men with tampers will tamp as much track as eight men will tamp with picks and bars, and the work done will last twice as long as if it had been done by hand.

Tie tampers will work under any air pressure from 60 lbs. to 100 lbs., but the best results are obtained with an average working pressure of 65 lbs. except when they are used for picking concrete; for this work 75 to 80 lbs. pressure will give the best results.

Ideal Tamping Results

The tie tampers should be worked in pairs, one on each side of the tie and opposite each other, Fig. 11. Hold the tie tampers perfectly vertical when starting with the broad face of the bar against the tie. Hold in this position until the face reaches the bottom of the tie,

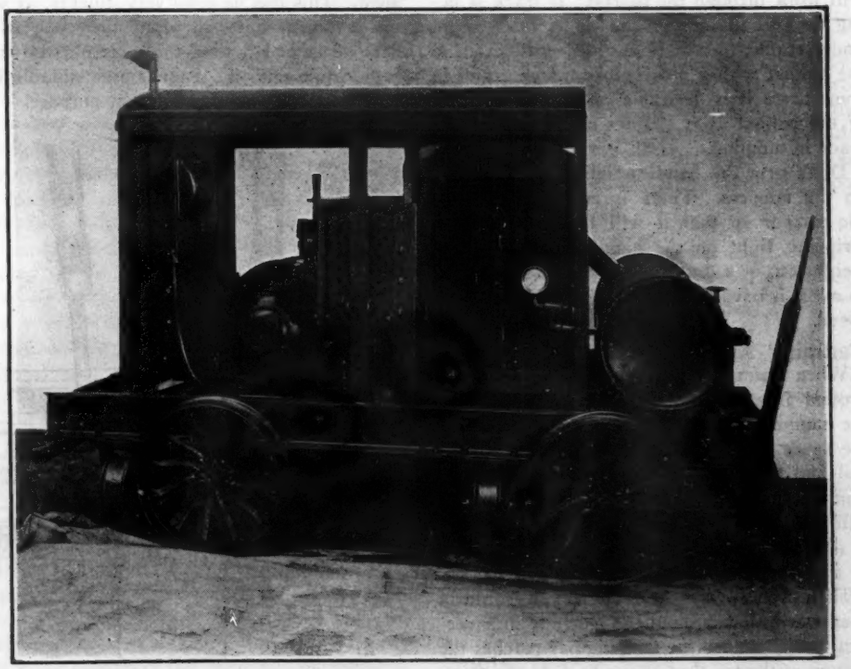


Fig. 4. Four tamper electric driven tie tamper compressor.

Fig. 5. Tie tamper at work on the D. L. & W. R. R.

Fig. 12, then swing both tampers back at the same time until they are at the proper angle to drive the ballast under the center of the tie, Fig. 13. Start under the rail and work to the end of the tie, then lift back to under the rail and work to about 8 or 12 inches inside of the rail. Do not allow men to stay too long on one tie as they will overtamp and hump the track. The average should be about two minutes to a tie, and that is, divided one minute outside of the rail and one minute inside of the rail.

If the tie is loose so that it pumps up and down under traffic, or the track is lifted out of face, it is not necessary to rake the ballast out from between the ties as the tamping bar will work through the ballast. If track is being tamped in face or the tie is fairly solid under traffic, then it is desirable to loosen up the ballast with a pick before tamping and in some cases it is desirable to rake out a little of the ballast as it enables more speed to be made in tamping.

Don't grip the handles tight and don't ride on the tampers. There is enough weight in the tamper so that it will feed itself down. Gripping tight on the handles, throwing the weight on, or riding upon the tool only tends to make it harder on the man and slow up the speed.

Tamping Around Switches and Frogs

When tamping through slip switches or around frogs where the space is contracted, the tamping bar should be inserted through the space with the broad face parallel to the rail and the machine held in a vertical position. It will run but a few seconds when it will displace a sufficient amount of the ballast to permit of swinging the tamping bar around so that the broad side parallels the cross tie.

Then proceed just the same as you would in open work, that is, hold the machine in a vertical position until the tamping bar reaches the bottom of the tie, then swing back at the proper angle to pack the ballast under the tie. A book of instructions for the proper care and maintenance of tie tampers and compressors has been issued by the Ingersoll-Rand Company.

How to Use Compressor Car

Place the compressor car on track on flanged wheels, Fig. 14, and run it under its own power to the point at which the tamping is to be done, Fig. 15, being protected in the usual method by train order or by flags. Then remove the car from the track to a permanent car rest erected on the side of the right of way, Fig. 16, or to a temporary rest made of a crib of tires, rolling it off sidewise on transverse trucks to the crib on the cross rails which are provided as part of the compressor equipment. This can be done very quickly, as with the 2-tool compressor, four men can easily lift one end at a time for inserting the cross rails, while with the 4-tool outfit suitable lifting jacks are provided for that purpose.

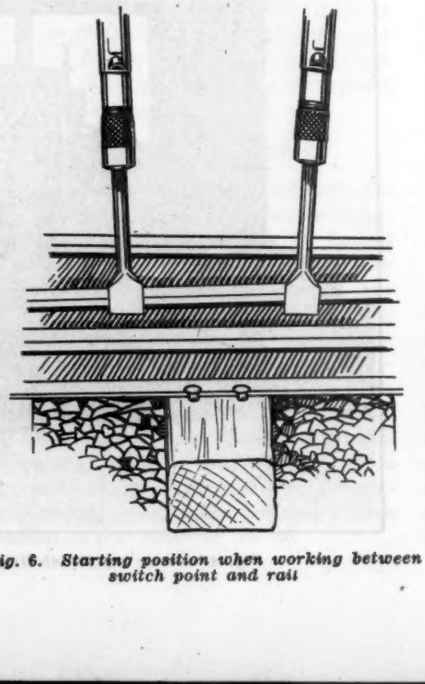


Fig. 6. Starting position when working between switch point and rail

After the car is placed on the car rest the hose lines are run out from the compressor and connected to the tampers and as these hose lines are 300 ft. long it permits the tamping of 300 ft. either way from the compressor, or 600 ft. of track so that at most it will only be necessary to make one move during the day, Fig. 18. At the end of the day the plant can be locked up and left on the right of way, or if preferred, it can be used for shuttle service, that is, can be placed back on the track and used for carrying the crew in to section headquarters.

The Electric Driven Compressor

This same procedure is carried out irrespective of whether the road is single track, double track, or four tracks, only in the case of the double track and four tracks, the hose line leading from the compressor is carried between the tracks instead of on the outside of the track.

In the case of the electric driven compressor used by street railways, the compressor rig can either be hauled behind a work car or street car to the location of the work and then set off to the side of the street, or it can be loaded on the work car and taken to the location of the work and set off to the side of the street after which proper connections to the overhead trolley system and proper grounding should be made. These cars are not self-propelled.

Two-Tamper and 4-Tamper Outfit

The 2-tool outfit is recommended where it is to be used strictly as a section equipment and assigned to individual sections or on single track roads where the maintenance gang is composed of not more than six men.

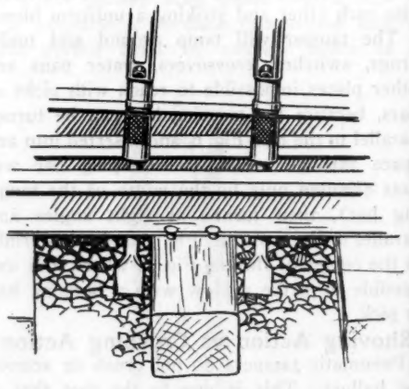


Fig. 7. Intermediate position

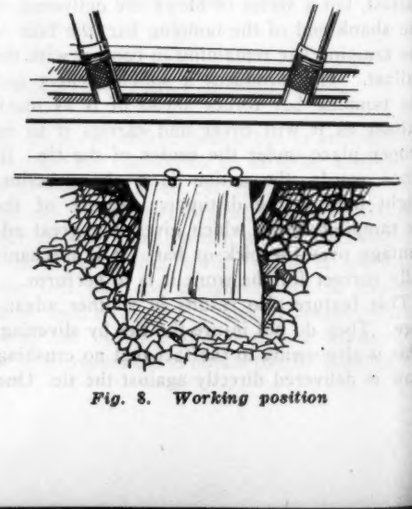


Fig. 8. Working position

The 4-tool outfit is recommended for service where it is to be assigned alternately to more than one section or to ballasting or floating gangs who will handle it continuously in general re-ballasting or re-surfacing, and leave the subsequent maintenance to the section gang.

How to Organize the Tamping Gangs

For the organization we will use as examples, that used by the New York Central

Fig. 9. Working position of men using the tamper

Lines East, which has adopted the 2-tool outfit and the D. L. & W. which has adopted the 4-tool outfit.

The New York Central Railroad East of Buffalo has standardized on the 2-tamper outfit. One outfit is assigned permanently to a section. A section averages twelve to fifteen miles of single track, that is, a double track section would be six miles and a four-track section would be three miles, etc. An oufit is used on an average of 100 actual working

Fig. 10. Working position of man using tamping pick

days per season of 200 days which leaves 100 days or one-half the total time for regular section work other than tamping and surfacing track. They consider the ideal size of a section gang working with a two-tamper oufit to be six men and a foreman, as compared with 12 men and a foreman for a hand gang. This, however, varies with the importance of the section, layout of the track and the density of the traffic. On account of the extreme shortage of labor they have been forced to get along with smaller gangs and have been able to obtain very satisfactory results which would be impossible without the machines.

On the D. L. & W. one 4-tamper outfit is assigned to two alternating sections ranging from three to four miles of two main tracks, or an average of seven miles of single main track per machine for a summer working period. This is on a basis of a four months' period being devoted to the tamping of ties, in connection with the two sections, each section gang raising half of its section per summer season, back filling the same with new ballast, placing sufficient ties in the other half of each section to take care of conditions throughout the balance of the season and tamping same.

Therefore, half of each section will be completely raised and reballasted, the other half of each section re-tied from the yearly tie standpoint and carefully tamped so as to place the entire section in good working condition to pass through the balance of the year. This method would guarantee the re-screening and renovating of one-half of each section every third summer with the regular section force. The average section gang with machines consists of eight men and a foreman.

With the 2-tool outfit it is all right to assign one man permanently to look after the compressor car, although it is not absolutely necessary, as in most cases the compressor can be looked after by the section foreman.

When a 4 tamper outfit is used we recommend that an operator look after the compressor, giving it his entire time. This man can be selected from the section gang by picking the most intelligent or the most apt with machinery and after a little instruction, would be competent to take care of and operate the outfit.

When one or more of the tie tamping outfits are in service on a railroad, some one person should be designated to follow up the compressor outfits to see that they are kept in continual service and to see that proper performance reports are sent in regularly.

In the accompanying illustration is shown the character of the report forms which have been adopted by several of the railroads who are using these machines. This enables the keeping of an accurate record of performances of the machines and the compiling of data to show a comparison of the machine method and the hand method of doing the work. It is also well to designate some one man to look after the proper maintenance of the compressor units to see that they are at all times in proper working condition.

It frequently happens that minor troubles will occur such as adjustments of carbureters, timers, etc., which if promptly and properly corrected, will insure against serious trouble. This duty is usually assigned to the mechanic who looks after the maintenance of the section motor cars or other machinery equipment used at pumping stations, etc.

It is the custom of the Ingersoll-Rand Co. on the delivery of each lot of "Imperial" tie tamper compressor outfits (irrespective of whether it is one or more outfits) within the United States to send at its own expense, a practical demonstrator to instruct the railroad forces in the proper handling of the tie tamper outfit to obtain the maximum results and also to instruct an operator, to be provided by the railroad company in the proper handling and

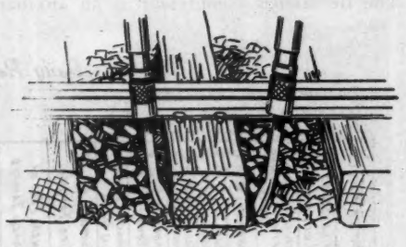


Fig. 11. Starting position on straightaway track

maintaining of the compressor unit, after which it is expected that the railroad company will continue the supervision by assigning some one competent man to look after the maintaining of these outfits, proper adjustments, repairs, etc.

In a number of instances the railroad companies have been permitted to send men se-

Fig. 12. Intermediate position

lected from their force to the Ingersoll-Rand shops for thorough and detailed instructions and this practice is recommended.

Present Scope of the Tie Tamper

The initial introduction of the tie tamper was in 1913. Today the tie tamper is introduced on 60 of the steam railroads of the United States, on 50 of the electric railroads, and all told there is in actual operation about 600 of the compressor units and over 4000

Fig. 13. Working position

of the tie tampers. On some of the roads they have been adopted in very large numbers.

For instance, the New York Central R. R. (Lines East of Buffalo) are operating 228 of the 2-tool units, the D. L. & W., 62 of the 4-tool units, the Pennsylvania Railroad 40 of the 4-tool units and in the neighborhood of 1000 tie tampers which are being worked from permanent air and signal lines; the B.

& O., 32 of the 4-tool units, and the B. R. & P., 20 of the 4-tool units, the C. C. & St. L. 20 of the 4-tool units, Lehigh Valley 30, Erie 27, New York Central (Lines West of Buffalo) 47, Illinois Central 11, New York, New Haven & Hartford, 10 of the 2-tool and 6 of the 4-tool, etc.

Compressor Unit Generally Useful

The tie tamper compressor is an auxiliary portable air compressor unit that is available for service any time of the year where compressed air is required. For instance, the compressor units may be used in an emergency for supplying air at railroad shops or other points for operating pneumatic tools. They may be used for the operating of riveting hammers, drills, paint sprays, sand blasts and other machines in bridge repairs, and by reason of being self-propelled, do not require the services of a train crew to take them out to work. They can be used by the Bridge & Building Department for the white-washing of cattle guards, the interiors of buildings, tool houses, etc. Figs. 19 to 25 show some of these various auxiliary uses.

We have records of where these outfits have been used in the winter months for pumping water and also for operating the tie tampers, in picking and unloading frozen coal from coal cars, frozen ore, frozen ballast such as cinders, etc., and for picking ice from around water pans, for operating air motors, driving rail drills, boring drills, wood boring machines, running nuts on angle bar bolts, for operating rail saws, grinders, and similar machines.

There is a very broad field for the use of these machines, and while it may seem that the field has been well covered and that the possibilities for further extension and uses are about exhausted, we are confident that other uses will suggest themselves and be developed. There is one thing that is paramount with the tie tampers and that is that the work performed by them is done in as permanent a manner as is possible, and after all permanency is the great labor saver. This applies particularly to present operating conditions.

Daily Report of Performance of Tie Tamping Machine

Division_____ Location_____
Section No._____ Date From_____ To_____ 19____
Machine No._____ Section Foreman.

Day of Week	Mile Post Location	Actual Number of Hours Machine Worked	Number of Hours Gang Worked With Machine: Foreman	Sub Foreman	Machine Operator	Laborers (Total)	Number of Laborers in Gang	Number of Ties Tamped	Lineal Feet of Track Tamped	Quantity Used of: Gasoline (Gallons)	Oil (Pints)	Grease (Pounds)	Character of Work: Kind of Work	Number of Hours Machine Was Idle During Working Day	Cause For Machine Being Idle: On Other Work: Hours	On Other Work: Kind	Hours: Account of Trains	Moving Machine	Machine Broken Down	Repairs: Hours Mechanic Other than Regular Operator Used	Repair Parts Used	Remarks
Sun.																						
Mon.																						
Tues.																						
Wed.																						
Thur.																						
Fri.																						
Sat.																						
Total																						

Note:—Number of hours gang worked with machine, should show actual time in connection with tamping ties and must not include time raising, digging out, lining, surfacing, filling in or dressing up tracks. When surfacing low joints, include time digging out, raising joint, filling in and dressing up. Time consumed in moving machine to be included in time gang worked with machine. Section foreman must fill out the above form each day and forward to roadmaster at end of each week.

United States Railroad Administration.
_____ Railroad Co.
Monthly Report of Performance of Tie Tamping Machine

Section No._____ Location _____
Machine No._____ Month of _____ 192
Division Engr.

Date From To	Total Hours Machine Worked	Total Number of Hours Gang Worked with Machine: Foreman	Cost	Sub Foreman	Cost	Machine Operator	Cost	Laborers	Cost	Total Cost for Gang	Total Number of Ties Tamped	Feet of Track Tamped	Quantity Used: Gasolins Gallons	Cost	Oil Pints	Cost	Character of Work: Advance Lift	Kind	Account Weather Condition	Cause Machine being idle: On Other Work	Account Trains	Moving Machine	Machine Broken Down	Total Hours All Causes

REPAIRS: Hours consumed by Mechanic other than Regular Operator	Cost Mechanic time	Repair	Parts Used	Cost Repair Parts	Total Cost Repairs	COST: Total Cost Operating Machine	Cost Per Tie	Cost per lineal ft. of Track	AVERAGE: No. of ties tamped per hour	No. of lineal feet of single track tamped per hour	Quantity Used per hour: Gasoline gallons	Oil (pints)	Remarks

Note:—Number of hours gang worked with machine should show actual time in connection with tamping ties and must not include time raising, digging out, lining, surfacing, filling in or dressing up tracks. When surfacing low joints, include time digging out, raising joint, filling in and dressing up. Time consumed in moving machine to be included in time gang worked with machine. Road master must fill out the above form for each machine on his division each month and forward promptly to office of Engineer of M. and W. and not later than the 10th of the following month.

Fig. 14 *to* 18 *shows methods of handling the tie tamper outfit from the placing of the car on the track to the final working position. Fig.* 14 *shows men placing the compressor car on track. Fig.* 15 *shows the same car being propelled under its own power. Fig.* 16 *shows the compressor car on the car rest in readiness for operation—tampers at work in the back ground. Fig.* 17 *shows the special type of car rest adopted by the New York Central R. R. composed of four cross-ties planted in the ground. Fig.* 18 *shows the usual type of car rest composed of a crib of ties. This illustration shows a plant on the D. L. & W. R. R.*

Figs. 19 *to* 25 *show auxiliary uses for tie tampers such as cutting asphalt (Fig.* 21*), picking paving blocks (Fig.* 19*), and the use of auxiliary track tools used with tie tamper compressor such as tie borer (Fig.* 22*), rail drill (Fig.* 23*), driving screw spikes (Fig.* 24*), riveting bridge girders (Fig.* 25*), and grinding switch point (Fig.* 20*).*

The Air Lift—Development and Application

Mistaken Ideas Prevalent Among Engineers should be Corrected—Necessity of Having Correct Data in Order to Obtain Best Results—Advantages of the Tapered Pipe in Maintaining Initial Velocity

*By H. T. ABRAMS**
Member American Society Mechanical Engineers

PUMPING BY the air lift system has been under consideration by engineers for many years but there still remains various phases of the operation of this device and results secured to be definitely determined. The author in this article stresses this lack of information among engineers in general who have not been properly informed in regard to the system, and the feasibility of securing remarkably high percentages of efficiency in performance. It is pointed out that failure to record all the data in connection with height of water level, output, behavior of water level during the period since drilling the well and similar information has operated to the disadvantage of a greater adoption of this system. The results secured from the use of a tapered pipe in a number of experiments are given in a chart on the opposite page. Considerable discussion has taken place in past years on this point and it is believed that the curves on this chart will prove of much interest.

PERHAPS ONE IDEA in connection with the air-lift pump has not been followed to the extent it should be, and that is a study of the geology of the adjacent territory to the place of the proposed installation so far as it relates to the water bearing areas. A little investigation of this kind in the reading of Government and State geological reports, gives a knowledge of the favorable localities for water, and the expected performances of wells. You are probably aware that one of the greatest difficulties air lift manufacturers are up against is to keep the users' ideas regarding the amount of water needed within reason.

Some influence from bygone days suggests that the air lift possesses magical properties that will *produce* as well as pump water. A common over-sight is to accept literally what the operator says in answer to the question,—How many gallons per minute are required from each well? It does not seem to make a particle of difference whether the well has been tested and found to yield only 25 gallons per minute at an economical depth, the inclination of the operator is to ask for 50 gallons.

If it were a mechanical pump of some kind he was thinking about, he would at once realize the limitations, but an air lift, to his mind, is different.

Mistaken Idea of the Air Lift

The air lift is popularly supposed to "increase the yield of the well," and, inferentially, perform in some mysterious way to "smite the rock," "open up seams"—ideas which he has gathered possibly from current advertising.

It is perhaps necessary to explain how these statements may be in harmony with the facts, and yet show that limitations must necessarily be placed upon the amount of water a well will yield, depending upon the character of the water bearing stratum, whether rock, sand, or gravel, and the kind and size of screens used, if any.

Furthermore, granting that a well, or group of wells, may yield the maximum amount asked for, it is not always good policy, or good engineering, to recommend a plant of such guaranteed capacity, because the drawdown necessary to induce such a flow may represent more than the economical yield. Keep the ideas of the management within reason; figure safely; and then you are in position to make a good showing.

The air lift is 27 years old, but even right now very little information is open to the engineering profession outside of manufacturers' catalogues, which, because of the necessary limitations of such a medium for disseminating technical information has left the reader confused as to the principle of operation, and entirely in the dark in matters of proper design.

Exact Data Is Necessary

When considering the installation of an air lift it is first necessary to obtain the well data, or verify the figures submitted by the company. The importance of collecting the exact data cannot be over-estimated. Most of the information furnished by the company falls down in answering one or more of the important questions. Let us go a little further into this subject, because of its importance, especially for the guidance of the beginner. When inquiries are made by the air lift expert, the boss on the job will attempt to furnish the information. He knows all about the well because he has to—"no one can be depended upon these days." Soon he will be hunting for the well driller's invoice to find out how deep the well is, i. e., how much footage he paid for, and about the time you reach question No. 5, he pushes the button and refers the matter to the superintendent. That move is the first in the right direction.

Past and Present Performance

The superintendent can add a little more information, but when question No. 12 comes up, it finds him side-stepping, and he, in turn, refers the matter to the engineer. You are now getting nearer home, as the engineer should be the man to give you about all of the data you require, but, in addition, you must not fail to inquire thoroughly into the present pumping conditions; the reason for making the proposed change; and all of the inside information about the water consumption of the plant; past and present performance of the well; and about other wells in the immediate vicinity.

If it is possible for the air lift designer to get out into the yard and look around for himself, he may frequently pick up valuable information, especially if he is fortunate enough to connect with an "old timer" who has been around since the well was put down, and can tell him something about trouble with screens; reduction in the diameter of the well; and how the water levels have behaved since first starting up.

Fundamental Feature Is Utility

With this information one source of information can be checked up against the other; the doubtful and non-essential matter can be read out, and the problem reduced to a working basis.

The big idea back of the air lift system is UTILITY. The public will eventually be educated away from a rather general feeling of uncertainty regarding the air lift system, especially among engineers, that the air lift is a makeshift, or temporary affair. The air lift, exmystery, should be the manufacturers' policy.

The common difficulty met with in a certain class of work is to determine the pumping level in a well, especially where the well is closed in, and there is not space enough between the well casing and the discharge pipe to lower a float. Wells should be piped in such a way that the air line close to the well can be fitted with an accurate pressure gauge, and the "shut in" pressure obtained by closing a valve between this gauge and the compressor.

Determining Amount of Submergence

A prominent author has laid down the following rules for determining the submergence from the pressure gauge:

First—Test the pressure gauge and determine its error at about the pressure of submergence.

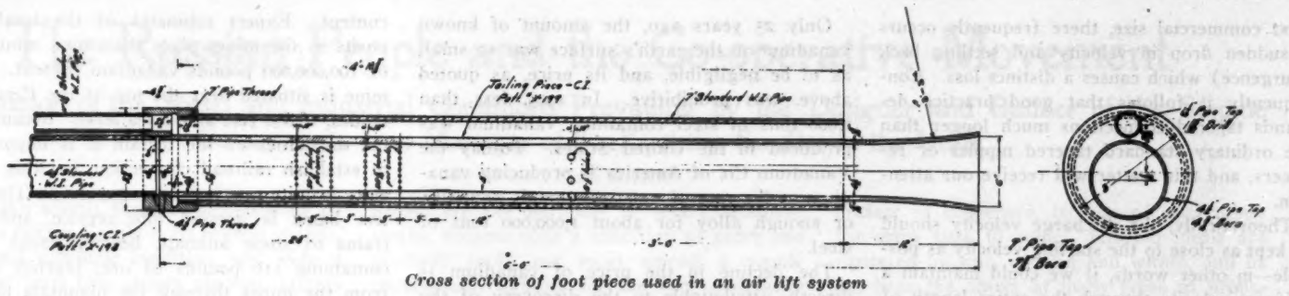
Second—Start the compressor as slowly as possible until the pressure gauge comes to a stop. This gauge reading will be that due to submergence, friction being eliminated by delivering only a little air.

Third—Speed up the compressor to normal speed and note the immediate increase of pressure. This increase will be due to all friction between the gauge and the eduction pipe at bottom of well.

Fourth—Run the compressor and pump at normal speed and delivery until the pressure ceases to drop, be this hours or days. The difference in gauge pressure as read in the third and fourth will be due to the lowering of the water level in the well.

It has been the practice of manufacturers to list air lift pumps as having a certain capacity in gallons per minute, and to accompany such data with tables giving the amount of air and pressure required to make various lifts

*An address before convention of Ingersoll-Rand sales engineers.



Cross section of foot piece used in an air lift system

with different percentages of submergence. Air lift pumps can have nothing more than a nominal rating, as the capacity of any pump varies according to the conditions of lift and submergence, so that capacity rating tables will have to be based on a total head, submergence and efficiency basis. For example, a 5-in. pump, lifting water 60 ft. with a submergence of 70.5 per cent. may discharge anywhere from 250 to 600 gal. per minute under efficiencies:

$$\frac{\text{Water Lift H. P.}}{\text{Isothermal Air H. P.}} \text{ of 75 to 40\%}$$

Pipe tables have also been in common use in which sizes of eduction pipes have been given for various conditions.

Such tables, at best, are only approximately correct, and although it is quite possible to cover in a fairly satisfactory way the ordinary run of conditions, yet the best results may not be realized because of basic principles which have been neglected, and which become more apparent when we encounter extreme conditions of lift and submergence in either direction. The absolute final efficiency of any air lift lies in the design of the eduction pipe based on utilizing proper velocities.

Capacity and Design of the Foot Piece

So far as a foot piece is concerned, it is important in the degree that it provides for proper inlet velocity for water; and correct velocity for the discharged mixture of air and water; as it divides the air into fine streams; and offers no opportunity for sudden change in velocity in the passage of the mixture through it.

The illustrations show a modified type of pump embodying these fundamentals. In this foot piece the average inlet velocity is five feet per second increasing progressively to the throat where it reaches seven to fourteen feet per second. At a point just above the throat the air openings are disposed in rows of small holes which serve to divide the air into fine streams, these holes decreasing in diameter from the bottom row to the top. The orifices are all on an angle of ten degrees from the horizontal.

A common mistake in the design of foot pieces of this type is to provide too large orifices, so that the air is able to pass through the upper rows of holes and cannot be distributed, and so there is no possibility of the air reaching the lower openings. The row of relatively large holes below the throat is provided to take care of any excess air which may not be handled by the standard openings in any size pump. They are to be considered simply as "governor" holes to prevent the escape of air.

This new design also fixes the air admission points *above* the throat or Venturi, in direct contrast to other makes on the market in which the air is admitted below the contracted area, the idea being to embody the injector principle, which is not only useless and wasted, but is opposed to the theory of minimizing hydraulic shocks consequent upon sudden changes in velocity. After a column of water is once set in motion, the velocity should never be dropped so as to cause a condition commonly called "surging."

Design of the Eduction Pipe

The design of the eduction pipe should aim to take a mixture of air and water from the foot piece and deliver this volume to the point of discharge with as little increase in velocity as possible. There are two points where velocity is usually considered, namely:

V_1—the point where the mixture enters the eduction pipe.

V_2—the point where the mixture leaves the eduction pipe.

V_1 is determined by the volume of *compressed* air passing through the air openings per second plus the cubic feet of water pumped per second. This gives a volume Q. Then, knowing the velocity required at this point, v, the size of pipe, a can be determined from the formula—

$$Q = av.$$

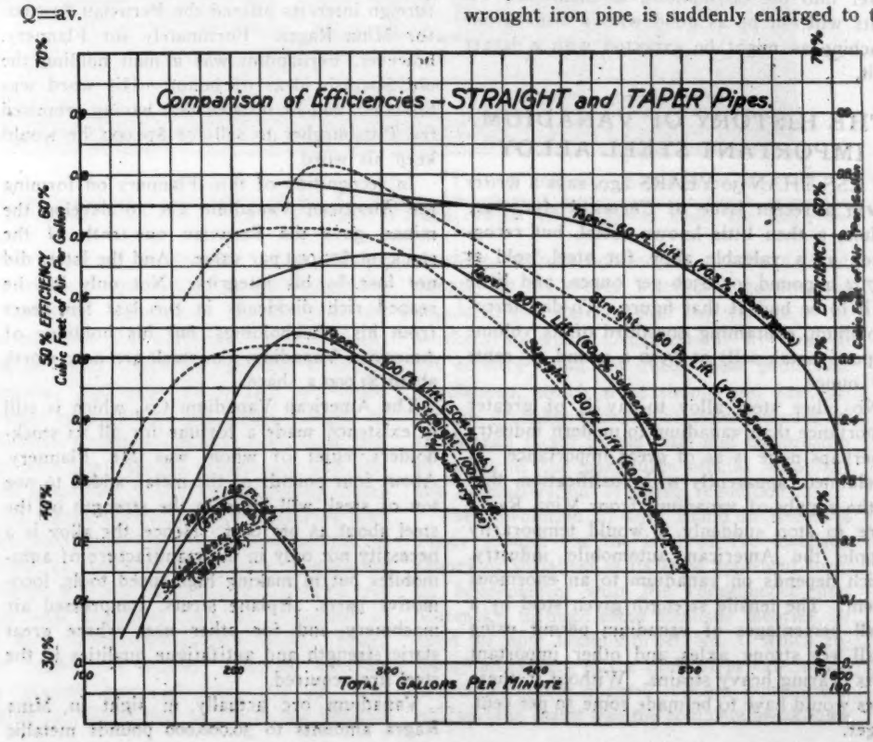
In the same way V_2 is determined by the free air required per second plus the quantity of water in cubic feet per second.

Since velocity is the controlling factor in the design and efficiency of any air lift pump, it is therefore important to establish the best values for V_1 and V_2.

There are so many variables entering into the action of an air lift pump that the results which will definitely fix allowable velocities in discharge pipes, depend upon experience and test, and we are in a fair way to obtain this information in every detail. The Ingersoll-Rand Co. has at its command a fully completed and finely equipped testing plant. The company has liberally provided every facility for making tests. It has a well eleven inches in diameter, 280 feet deep, with all necessary conveniences for handling pipe, including a 58-ft. derrick, steam hoist, and complete equipment for measuring water and metering air. Results from our tests show that the mixed column of air and water leaving the foot piece should be maintained as near the entrance velocity as possible throughout its travel to the surface.

Advantage of a Tapered Pipe

A tapered discharge pipe lends itself to this idea, but unfortunately, true tapered pipes are not yet on the market, and where standard wrought iron pipe is suddenly enlarged to the



next commercial size, there frequently occurs a sudden drop in velocity and settling back (surgence) which causes a distinct loss. Consequently it follows that good practice demands tapered connections much longer than the ordinary standard tapered nipples or reducers, and this matter will receive our attention.

Theoretically, the discharge velocity should be kept as close to the starting velocity as possible—in other words, if we could maintain a uniform velocity through the entire length of the eduction pipe, the best conditions would be realized. In almost every case this would mean a prohibitive size of pipe at the top, considering the diameter of any ordinary well, so that the best design will aim to keep this discharge velocity as low as possible.

Efficiency 65 to 70 Per Cent.

The air-lift pump, as a pump, is actually an efficient device contrary to general understanding. A properly designed air lift should show 60 to 75% efficiency, but unfortunately the pump itself is tied up to an air compressor, so that, taking into consideration pump losses, air transmission losses, and the primary loss in compression, the over-all efficiency may be reduced anywhere from 45% to zero. The greatest loss occurs in the air compressor; next the loss of energy from the foot piece to the point of water discharge, and the third, in transmission of the air from the compressor to the foot piece. It is very rare that tests made undertake to separate these sources of loss, and the air lift shoulders the whole performance. At the same time the air lift may be working at a fair rate of efficiency, but happens to be tied up with a compressor of poor design or in bad mechanical condition. Therefore in figuring any proposition for final over-all efficiency, the size and type of compressor must enter into the calculations, as manifestly results will not be as good with a 6-in. stroke machine as might be expected with a larger unit.

THE HISTORY OF VANADIUM, IMPORTANT STEEL ALLOY

LESS THAN 30 YEARS ago, says a writer in a recent issue of *Chemical Age*, vanadium, a then little known metal, but recognized as a valuable alloy for steel, sold at $4,792 a pound, or $300 per ounce, and little of it to be had at that figure. To-day ferro-vanadium, containing one-third of its volume in pure metal, sells at $5.50 a pound, 35 cents per ounce.

No other steel alloy to-day is of greater importance than vanadium to modern industry—perhaps none is as of great importance. It is claimed, apparently with justification, that if the supply of vanadium from Mina Ragra were to stop suddenly it would temporarily cripple the American automobile industry, which depends on vanadium to an enormous extent. The tensile strength given steel by a small percentages of vanadium permit using small yet strong axles and other important parts bearing heavy strains. Without it, these parts would have to be made some 50 per cent. larger.

Only 25 years ago, the amount of known vanadium on the earth's surface was so small as to be negligible, and its price, as quoted above, was prohibitive. In 1905, less than 1,000 tons of steel containing vanadium was produced in the United States. To-day the Vanadium Co. of America is producing vanadium at the rate of 3,000,000 pounds annually, or enough alloy for about 1,000,000 tons of steel.

The decline in the price of vanadium is directly attributable to the discovery of the immense vanadium deposits at Mina Ragra, Peru. These deposits were discovered in 1905 upon the holdings of E. E. Fernandini of Peru. The vanadium deposit found on this property was a geological phenomenon, no comparable deposits of the metal being known of in any other part of the world. The amount of vanadium in these deposits is estimated at 95 per cent. at least of all the metal available, with a yield of nineteen per cent. in metal.

James J. Flannery of Pittsburgh, formerly an undertaker, was the first to recognize the enormous possibilities of vanadium. Mr. Flannery was not a wealthy man and he was unable to raise more than $20,000 to purchase and develop the mine, of which he allowed $10,000 for the purchase and a similar amount for development.

Mr. Flannery knew that the $10,000 which he could offer for the mines was not an attractive price, but being a student of human nature he knew the attraction that minted gold has over checks. Hence, he went down to Peru with a carpet bag containing $10,000 in American gold pieces and when Mr. Fernandini seemed unwilling to accept the price opened the bag and spread out the treasure at the Peruvian's feet. The glitter of gold won.

The transaction, however, was not consummated immediately and within a day or so, foreign interests offered the Peruvian $200,000 for Mina Ragra. Fortunately for Flannery, however, Fernandini was a man holding the old Spanish ideas of honor. His word was his bond, and he insisted that having promised the Pittsburgher to sell for $10,000, he would keep his word.

In recognition of this, Flannery on forming the American Vanadium Co. to develop the mines, gave the Peruvian one-tenth of the stock, or $70,000 par value. And the latter did not lose by his integrity. Not only has he reaped rich dividends in the last ten years from his stockholdings, but his holdings of American Vanadium Co. stock are now worth about $1,000 a share.

The American Vanadium Co., which is still in existence, made a fortune for all its stockholders, chief of whom was Mr. Flannery. About four pounds of the metal, added to one ton of steel, will increase the strength of the steel about 45 per cent. Hence, the alloy is a necessity not only in the manufacture of automobiles but in making high-speed tools, locomotive parts, airplane struts, compressed air machinery and for other uses where great static strength and antifatigue qualities in the steel are required.

Vanadium ore actually in sight in Mina Ragra amounts to 36,000,000 pounds metallic content. Expert estimates of the total deposits in the mines place them at a minimum of 100,000,000 pounds vanadium content. The mine is situated near the top of the Peruvian Andes, 16,800 feet above sea level. Because of the difficulties of the terrain it is impossible to establish railroad connection, but this difficulty is quite satisfactorily overcome. The native llama is pressed into service, and ore trains of these animals, bearing sacks each containing 110 pounds of ore, journey daily from the mines through the mountain passes to the nearest point on the Peru Central Railway, a distance of 28 miles.

Transportation under such conditions is just the job that the airplane is now looking for, and it would not be surprising if in the near future we should hear of aerial transportation of vanadium ore.

PROPOSES SHAFT TWELVE MILES DEEP

Sir Charles Parsons, lecturing recently at the Royal Institution, referred to his proposal for sinking a bore hole twelve miles deep into the earth. He said that the cost of boring the hole would not be so very great. In countries where the atmosphere is dry the sides of mine shafts are cooled by sprinkling them with water, the evaporation of which cools the rock. This effect might be augmented by artificially drying and cooling the air before passing it down the mine. With still greater depths of shaft further methods of cooling would probably be necessary. The heat might be carried upwards by means of brine circulated in a closed ring of steel pipes with a rising and descending column, or a simpler method would be to arrange for a rain of liquid air down the shaft. When sinking the deeper portions of the shaft probably shields would be required to protect the miners from the splintering of the rock, since the intense compressive stress splits off scales from the surface, sometimes with considerable violence. When he first brought forward his suggestion, in 1904, the estimate of the time required to sink a shaft twelve miles deep was eighty years; but with improved machinery and methods the records have been so much lowered that he now thinks an estimate of thirty years reasonable.

The American Locomotive Company has received, orders for 105 locomotives, the cost of which will be about $7,750,000. Of the total number, 50 are for American railroads, 35 being contracted for by the Union Pacific and fifteen by the Louisville and Nashville. The ordering by the two American roads it is believed by some will be the forerunner of some substantial orders for equipment which will be placed by the carriers when they have been returned to private ownership. Fifty-five of the locomotives ordered will go to the Canadian National Railways. Of the Union Pacific order nineteen are to be of the Mallet type and sixteen Mikado engines. The Canadian order calls for twenty light Pacific type, 25 Santa Fe type and ten heavy Pacific type. The Louisville and Nashville has ordered fifteen Mikados.

The Russian People and the Co-operative Movement

A Discussion of the Social and Industrial Conditions Prevailing by the Designer and Builder of the Steptoe Smelter who was Manager of the Kyshtim Smelter in the Urals

*By WALTER PERKINS**

IT SEEMS almost sheer presumption to attempt to discuss Russia in its present chaotic, political and economic condition, and were it not that at least two certain absolute factors are continuously at work, it would be impossible to even approach the subject with any degree of intelligence. These are the inborn love of peace of the people and the national character of the co-operative movement.

The love of peace inborn in the soul of every Russian, the desire to be left alone and to live his life among his home village surroundings, is probably one of the two greatest factors that will make the continuance of the present conditions of civil war impossible. One army or the other may sweep up and down the country but the Russian peasant will remain in his own village if not literally driven out. This love of peace is evidenced by the fact that there is no country where personal safety is greater than in Russia in normal times. I have traveled in many isolated parts, carrying considerable sums of money and personal equipment that, in itself, would be a fortune to any peasant, and have never even encountered a condition that the most wildly imaginative person looking for adventure, or trouble, could muster up even a suspicion of fear.

Peasants Not Normally in Straits

This statement applies also to Southern Siberia and Northern Turkestan, which is inhabited by the nomadic tribes of Khirghese origin. It must be a self-evident fact that these people are not normally in severe economic straits, because such a condition of peace and goodwill could not exist among a people continuously fighting for the very sustenance of life. Want in its fighting form did not exist in the country prior to the present abnormal times. The statement that the people were well fed and clothed is accurate, barring that omnipresent submerged few that does and always will exist even in a land flowing with the proverbial "milk and honey."

The real requirements of the human being are only those which, when present, gives the mind a feeling of contentment and happiness, and that this condition did exist in Russia was apparent to any observant student of human nature and life, traveling in even the remote villages of the country. The popular theory of the down-trodden peasant may have some political significance to the traveler, compared with the complex conditions prevailing in other countries claiming a higher civilization. But after all is said and done, the simple happiness of the simple thought of the Russian peasant compares more than favorably with the complex weaknesses and discontent generated by the high-sounding statement of higher civilization and, whatever may be the final outcome of the present pitiful condition of the Russian peasant, I question very much whether the result will give to him greater real happiness than he possessed in those now dreamed-of-prewar days. There is no doubt that greater so-called liberties bring greater responsibilities and the tendency of the future will, as far as the Russian peasant is concerned, be one of uncertainty for some time to come. His old ideals are shattered by war, without and within, and he has been the object of many types of propaganada, with the consequence that his simple mind must be a whirl of conundrums, none of which he can answer; all in the name of advancing civilization for his betterment, but not taking into account that the simple ideal of spiritual religion has been taken away, to be replaced by some political creed that has no soul or spiritual inspiration, but is supposed to increase and give to him some new form of that misused word liberty.

Benevolent Form of Government

The old system of church and state autocratic government with all its faults was, as a whole, at least benevolent, and there is no country in the world where the government regulated and watched over the welfare of its workers so well. Organizations working in the country could not evade these protecting regulations, which were simple and just, although probably irksome at times because of the human factor of the state and the breadth of mind of the particular official who had the administration of these regulations.

The Revolution of 1917 found in Russia a ready ground for the trial of the idealistic theory of socialism in its most approved form of benevolence, with the consequence that Kerensky, through these idealistic theories, issued his now famous order No. 1, which reduced all officers to the rank of private, abandoned the salute, formed soldiers' committees, etc., and the result was the complete breakdown

At the very moment that Admiral Kolchak expected the world wide recognition of his All Russian Provisional Government at Omsk came the unexpected blow from the Bolsheviki which resulted in his retreat from Ufa. Here is illustrated a hasty retreat of his forces down the hill from Stepanovka to Maximovka.

*An address before the New York section of the American Institute of Mining and Metalurgical Engineers.

© Underwood & Underwood, New York.

North Russian types familiar to returning American veterans of the Siberian campaign

of the discipline of the army and navy and its consequent complete chaos. This condition, combined with the general war chaos, degenerated the entire social structure of Russia so that in a few months the extreme form of Marxianism, or Bolshevism, was initiated by Lenine and Trotsky, the history and tragedy of which are now known. The fundamental conception of Bolshevism is, of course, a reorganization of society on such a basis that there shall be no private or individual property in land or any means of production and no other form of income than that paid by the state for productive services rendered to the state. Therefore, there will be no rent, no profit, no interest, and no wages in the sense of wage paid by one individual to another (see Bolshevism by Henry C. Emery. "The Yale Review," New Haven, Conn.). This is a complete destruction of all rights in all form and is to be imposed upon and maintained throughout the entire world by a self-appointed despotic few.

The Co-operative Movement in Russia

What will be the eventual solution of the problem? The second factor mentioned in the early part of this address will probably play an important part in the regeneration of Russia. This factor revolves around the force of the co-operatives. The co-operative movement in Russia is national in character and is a common-sense, constructive, fair policy for handling the trade, finance, and labor of the country, capitalistic in principle but without the inflation of either modern finance or labor. In Russia, it can be divided under three headings: Labor in artels or societies, producers and consumers co-operative societies, and peoples' banks or credit institutions.

In Russia and Siberia, about 75 to 85 per cent of the people live on the land. Upon the abolition of serfdom, in 1861, the peasants were given land as individual holdings or as communal holdings. Under the first scheme, the peasants received a perpetual tenure specified plots of the land allocated to the villages or town in which they had lived, also a fixed share in the communal lands and forest belonging to the village. The fixed share in the forest is important to the life of the peasant, as it means the insurance of his fuel supply, which is apportioned to each family yearly at the cost of labor and haulage performed by the peasant himself.

Under the second scheme, the peasants were given a small piece of ground for cottage and garden only, in the village proper, while the available land, pasture, and forest were communal property and the pieces of land cultivated by each village householder lay in the communal lands adjacent to the villages. This system was adopted by the late Brigham Young in laying out the original Mormon holding in the Salt Lake Valley.

Communal System Not a Success

This second, or communal, system is not a success for the peasants do not live on the land that yields their livelihood and only go there when it is absolutely necessary, preferring to stay in the village and enjoy themselves. This does not make for good farming and in recent years much has been done toward the peasants to live on the land they cultivate.

The co-operative movement was instituted in Russia some 300 years ago by a feudal prince who had visited England and watched the working of the Guilds, but it was not until about 20 years ago that the movement became an important factor. At the present time every important section of workers has its own artel or association. In the more simplified form, a number of, say, carpenters, may band together for a summer's contracting work; at the end of the season they divide the accumulated earning and disband. On the other hand the Cashiers Artel is a permanent highly organized institution which trains men, or sees that they are trained, and

© Underwood & Underwood, New York.

Cloth Market of "The Fair" at Nishni Novrogod

supplies organizations in any part of Russia or Siberia, with men as nearly as possible especially fitted for the type of work in hand.

Producers and Consumers Organize

As suggested by the title, these societies exist in many, if not nearly all, of the important villages for the purpose of obliterating the profiteering "middle man"; they buy and sell individually or collectively either by cash or barter to the best advantage.

A noteworthy example of the larger co-operative is shown in the affairs of the Union of Siberia Creamery Assn., which started business in 1908, having associated with it 65 creameries, all village co-operatives, and 12 buying and selling stores making a turnover of $1,700,000; in 1916, the turnover had increased to $5,000,000 and there were associated with it 1,000 creameries and 800 stores for handling produce, besides which it had its own butter-selling agency in London. Because of this success in the butter business, co-operative flour mills, grain elevators, oil mills, etc. have, in recent years, sprung up very rapidly.

Co-operative Banks

Simultaneously with the formation of the artels and co-operative buying and selling societies, small credit associations sprang up to accomplish for the villager the same result that the material buying and selling stores had done, which was to do away with the usurer and give the small farmers credits without destroying them. These village societies obtained their funds partly among themselves with assistance from the State Bank. The development of the co-operative movement had been so rapid that the All-Russian co-operative Congress decided, in 1909, to form the Moscow Narodny Bank, with a capital of 1,000,000 rubles divided into 400 shares of 250 rubles each—85 per cent. of these shares were taken by the unions and small co-operatives all over Russia. The main object of the bank is to supply the Russian co-operative societies with credit within the limits of their needs in a convenient form and on easy terms.

The State Bank, being skeptical of the probable success of the Narodny Bank, refused it a credit account of even modest proportions; later, however, it changed its policy. The capital of this institution is now 2,000,000 rubles, 91.6 per cent. of which is held by the small co-operative institutions. The deposits, on Jan. 1, 1915, were $2,000,000; on Jan. 1, 1916, $14,000,000; on Sept. 1, 1916, $25,000,000. The turnover, in 1915, equaled $121,000,000; and in the first eight months of 1916, $245,000,000.

It is obvious that such enterprise could not long content itself or do justice to the general co-operative movement by simply confining itself to a purely banking business, so it branched out into the wholesale purchase and sale of all materials required by the co-operative societies, which business it did on a profit of from one to three per cent. for expenses. This department has proved to be an immense success. The Moscow Narodny Bank seems to be the link, or cement, that bonds together the entire co-operative movement in Russia.

As mentioned in the opening paragraph, I think it is apparent that the two factors—the inborn love of peace of the people and the co-operative movement—are both working out the salvation of Russia. Lenine in a recent speech stated that his idea of despotic Marxian communism was impracticable as long as the peasant had capitalistic ideas and by virtue of these ideas would only sell his excess grain for personal gain instead of working for that idealistic myth—the common good. Further, that it was also impossible to carry on technical work without employing at fabulous salaries the bourgeois technician.

Lenine's Despotism Failing

It is easy to stretch one's imagination enough to see that the real trouble Lenine has lies in the fact that the co-operatives still "carry on" and instead of being crushed by idealistic despotism are, in reality, largely solving the problem of the new Russia. Exactly what political form this new Russia will take no one knows. There is one thing that seems certain, the co-operative societies are national living facts and forces founded on a sound economic basis, which no amount of tyranny of any description can extinguish and are therefore bound to be very potent factors, if not the mainspring that will cause the early destructive Bolshevistic ideas to modify its policy and try to meet the inevitable failure that it faces on economic grounds alone.

It seems impossible to close this address without referring to general world conditions of capital and labor. In the early days of trading, business was carried on by firms of one or more individuals who had a personal interest in all the affairs of that business, with the result that there was a large personal factor permeating through the entire personnel. Later, capital, for many years, formed companies for various purposes, having no personal factor and consequently no interest other than absolute material gain and always having in mind its enterprises obtaining a "discounted ahead" profit that was not legitimate, the method known as "watered stock" or inflation.

Labor Turns to Radicalism

Labor began to desire part of this illegitimate profit and started inflating, watering, or raising wages so that over a period of, say, 20 years, capital and labor have been running individual and selfish enterprises, detrimental to sound economics to such an extent that the cost of production has come to its breaking point and the people, who are the unorganized majority, pay the price of both of these forms of false economics.

Now labor has become so strong in its organization that it desires to own capital and the people in the form of another kind of false economics, i. e., nationalization, which is nothing more nor less than another type of inflation super-imposed on the "watered stock" of the old capitalist plus labor's own wage inflation, with the addition of political "hot air" of the professional politician and agitation of varying degrees of radicalism, the extreme point being absolute destruction of all form of property, or Bolshevism.

While labor has been watering wages, thereby raising the cost of production and reducing it in quantity, it has neglected the purchasing power of a unit of money, merely calling for more units of money and less hours of work; it also has neglected entirely both the quantity and the quality of its unit of money purchases. As a result, the middleman of all grades keeps pace with each rise in wages, reducing the purchasing power of the latest rise.

Labor, at last, realizes that it is not possible to get more units of money or shorter hours, so the radical element calls for absolute ownership. This means the complete stifling of the initiative of constructive enterprise. A few of the saner labor elements see the path out by forming co-operative associations along the lines laid down by Rochdale; this is a step in the right direction. It will use the labor organizations' money and the energy of the leaders and will go far toward solving the problem of the social unrest paramount in the world today. The real solution, however, will not come until the people take the matter in their own hand and form co-operative associations for handling all of their affairs to which the principles can be applied. Then private enterprise will be stimulated and a general healthy period in the world's progress will ensue because parasitic monopolies of all types will be eliminated, for the co-operative societies will make it possible to eliminate the middleman.

Russia has gone a long way toward this goal, eliminating the usurer and the middleman, devoting and directing the energy and intelligence of the people toward a solid constructional work, in contrast to the semi-political demagogue labor union of the truly western world, which has yet to show, broadly speaking, the first intimation of even a dawning intelligence in the solution of the labor problem and the betterment of its members on a basis of sound economics.

The coöperative principle is capitalistic, but is non-inflatable, therefore non-speculative, sound in basic economics, and humanizing in its effect on both general capital and labor.

Spanish emigrants to foreign countries in 1919 totalled 71,720, compared to 20,168 in 1918.

Following its policy of encouraging established American steamship companies rather than competing with them the Honorable John Barton Payne, chairman of the U. S. Shipping Board said in a recent address that the Board will place in service under the management of Messrs. W. R. Grace & Co., the *Santa Teresa* and the *Santa Elisa*, both 13-knot ships, now reconditioning after release from Army service. These, together with the *Santa Luisa* and the *Santa Ana* now operated by Messrs. W. R. Grace & Co., are combination freight and passenger vessels built especially for this trade. They will call at Callao, Arica, Iquique, Valparaiso and will furnish sailings every two weeks from New York. A sister ship, the *Santa Leonora*, still in the Army service, will be added to these as soon as possible."

How Compressed Air is Applied in Textile Mills

THE manifold uses of compressed air in our manufacturing industries of today would astonish even the air compressing machinery man of twenty years ago. In scores of lines of manufacture air is now equally important with electricity and steam; in some it is of course absolutely indispensable both insofar as methods and economics are concerned. The subjoined article, which we reproduce complete from the columns of our observant neighbor, The Literary Digest, is an informative and highly interesting discussion, in popular vein, by a writer in The Textile World Journal of New York, on the uses of air in New England textile factories.

A LARGE air-compressor plant is now an important part of every large textile-mill. Spreading widely beyond its initial use for operating the spraying devices used for moistening the atmosphere, compressed air is now used for cleaning both the machinery and the raw product, for "stripping the cards," that is, for removing from the carding-machines the loose cotton or wool fluff that adheres to them, for operating all tools employed throughout the factory, for pumping water, and for automatically controlling all sorts of processes incident to the manufacture of textiles. Our quotations are from an article contributed to *The Textile World Journal* (New York). The writer notes at the outset that where compressed air was formerly used for accomplishing a few definite results, it is now installed as the medium of extensive services of great importance. He goes on:

"The familiar use of compressed air as a means for breaking up and spreading aqueous vapor for humidification is so well known that its description is not particularly interesting at this time. Yet we should mention, in passing, that it was largely this use in humidifying systems which brought to the attention of mill executives the possible uses for such an agent in accomplishing many of the long train of services which have resulted in recent years. It was natural to experiment with compressed air for various purposes in mills when its presence invited such investigations. From this facility it was but a step to ascertain what would be the result of shooting a stream of air among the complicated and inaccessible parts of a loom, spinning-frame, or other machine.

"But there is more than the merely novel idea of cleaning machinery by compressed air. It was soon found that it was not only possible to clean more easily, but far more cheaply than by any other method. A degree of cleanliness was also found possible which was out of the question with the use of the loom-cleaner brush.

"Cleaning of machinery is done by two methods. One uses direct application of an air-stream. The other uses an induced air-current, or vacuum, set up by passing the air through an injector. This induced current is widely useful for reaching certain inaccessible places.

"It was in line with this growth that vacuum-stripping processes for cards were introduced. Their rapid utilization has amply demonstrated their value, and like other uses of controlled pressures, either positive or negative, have found a constantly growing demand on the capacity of the outfit originally installed.

"An increase in production has also stimulated the use of vacuum card-stripping, for it is found that the reduction in time consumed in stoppage of cotton-cards enables an increase of production of about eight per cent. In the woolen system it is much greater, as stripping woolen cards requires much more time than stripping cotton, and the saving here is about twenty per cent.

"The net result of vacuum card-stripping includes a great reduction of the offensiveness of one of the most troublesome operations in textile-mills, with an increased usefulness of the operatives."

But there are new uses of compressed air which promise to surpass everything hitherto attempted. It is known, the writer tells us, that many processes now being performed by mechanical means can be done to better advantage by use of compressed air. For instance, the expansive power of air, when applied to a mass of cotton, will detach and expand the mass of fibers in a prompt and gentle fashion. If a stream of compressed air is inserted by placing the nozzle of an air-hose against a bale of cotton, it will be found that the bale will swell up like bread raised by yeast. It will grow to several times its original size. This same principle may be applied extensively to the cotton mass till it is finally expanded into a fluffy condition. We read:

"A system for opening and cleaning cotton by compressed air has been installed in the American Printing Company's plant at Fall River, Mass. It uses a trunk conveyer into which compressed air is shot by means of nozzles so placed that they direct the air into the mass of cotton passing along and hurl the fibers against impingement bars which shake out dirt. It has been found to clean and bloom the cotton thoroughly before delivery to the lappers, and is said to permit the use of one or two lower grades of cotton for equally good cloth. Such a demonstration of the value of compressed air, while experimental, is but a hint of future application.

"In the metal trades there is common familiarity with the long line of pneumatic tools which serve that industry. And the usefulness of similar appliances more peculiar to the textile field is rapidly being appreciated. Air-lifts for every heavy tool in the plant, as well as for service over looms, warpers, and twisters in connection with overhead trolleys, often solve a handling and transport problem.

"Raising water from supply wells has become common through use of compressed air as one of the most satisfactory means for accomplishing this result. Such a plant is commonly used in connection with boiler-supply systems or condenser apparatus. Its economy and practicability are rated highly. For there is practically nothing about the system aside from the general air-service to get out of order.

"There are so many uses for compressed air in connection with construction work that they are difficult to enumerate with accuracy, particularly as such uses vary widely in different localities. Yet we should mention such items as pneumatic hoists, pneumatic drills, pneumatic hammers, chisels, and riveters, forge-blowers, Bunsen burners, acetylene torches, and gas-furnace operation."

It has been remarked by competent engineering authority, the writer goes on to say, that the uses for air-service in the construction work of a 25,000-spindle mill are so great as to pay for the entire cost of an air-compressor outfit suitable for the needs of the mill. He continues:

"The question naturally comes to mind whether the size of the air-service ultimately to become common in the larger textile plants will not make feasible the use of several small units electrically driven and scattered throughout the plant. Considering the friction losses in transmission of air, this seems a plausible proposition for many plants, in spite of the fact that the economy of the larger units is apparent where they are demanded. If cotton opening by compressed air is extended, it may carry requirements so far beyond the possible central unit that there will be no question about the installation of more than one machine. And there are possibilities for further extension of air-service to include other textile machines.

"Even air-operated fire-doors have been suggested to be closed from a central station. In addition to all of the facilities mentioned, there is a long line of air-operated control devices for controlling the inlet of steam, etc., into processing machinery and equipment throughout the textile field. This is an important and constantly growing demand upon the service, yet one which does not use any considerable volume of compressed air. But one can not avoid the speculation that the presence of such control devices is bound to suggest their use for many other purposes of a similar character.

"For instance, since compressed air is now used to operate the automatic controls of humidification systems, why is it not likely that such control instruments will be applied to individual machines whose operations are known to be possible of improved operation by a differential application of humidification? This means, in substance, that such machines could be operated in a locally controlled medium of air, having a humidity content much beyond that which would be tolerated by operatives in the normal atmosphere of the factory. It is known that the operation of combing, for instance, could be carried on with a much improved effect upon the fiber if done in an atmosphere practically saturated with aqueous vapor."

The Technology of Air as a Power Medium

A Discussion of Properties of Air Under Varying Conditions—Air is Best Adapted Source of Power in Many Instances—Influence of Impurities on Air Power

By J. S. NEGRU

Mining Engineer, New York

"The generality of men are so accustomed to judge things by their senses that because the air is invisible they ascribe but little to it, and think it but one remove from nothing."—*Robert Boyle.*

OF ALL the wealth of natural resources which are at our disposal, air, which is primordially useful to our welfare, has not yet acquired the fully deserved place on the credit side of humanity's ledger of technology. This faulty book-keeping can be attributed to the facts that the air is so-called free, that it is found everywhere and that but very few have any well determined knowledge about its characteristics other than those commonly conveyed by the expression, "fresh air."

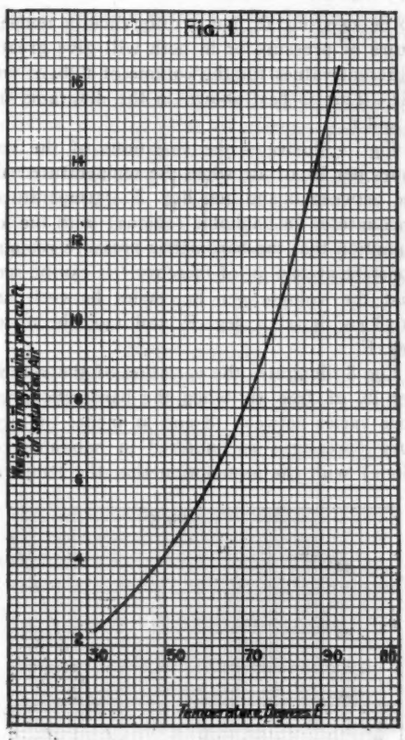


Fig. 1—Relation between temperature and weight of moisture per cu. ft. of saturated air at atmospheric pressure.

Air as a biologically needed essential food, is, beyond any doubt, appreciated by all, but not many see in its physical properties an inexhaustible source of mechanical power.

The amount of air power used today is practically a negligible quantity when compared to other power sources, but the variety of applications for which it is the best adapted power and the progress realized—and to be realized—in air-power generators and motors mitigate strongly in favor of the often repeated statement that it is rapidly gaining headway in modern mechanical appliances.

Composition of Air

Air, the gaseous substance which envelops the earth and which in common parlance is called atmosphere, is a complex mixture of gases containing in suspension, vapors and solid particles in proportions varying with local conditions. In round figures the composition of the air might be given as:

a—By volume—21 parts of oxygen and 79 parts of nitrogen.

b—By weight—23 parts of oxygen and 77 parts of nitrogen.

It must be borne in mind that these round figures are given merely to show the preponderance of the two main constituent gases. In reality our atmosphere contains besides oxygen and nitrogen a number of other already known—and maybe some yet unknown—gases,* besides impurities such as water vapor, carbon monoxide, carbon dioxide, ammonia, nitrogen oxides, ozone, hydrogen, hydrogen peroxide, acids, alkalis and minute particles of solid bodies.

THIS IS the first article in a series which will be published by Compressed Air Magazine on the general subject of Air Technology. The series is intended to review the whole subject beginning in the first article with the fundamental formulae expressing the relations between pressure, temperature and volume, upon which the engineering calculations for the design and installation of air power machinery are based.

In following articles it is intended to discuss the fundamental principles of air power technology and their corollaries, and a succinct historical review of the pioneering in air power applications. These are to be followed by a series of contributions on the theory and practice of the different groups of air power machinery and appliances. The reader will perceive that the subject is to be handled so that the succession of articles will preserve a logical continuity marking various stages in the scientific development of the industry.

Influence of Air Impurities on Air-Power Technology

All the air impurities although present usually in relatively small quantities are harmful in a degree more or less marked to the efficiency of air-power machinery. The most harmful are:

(a) Water vapors due to their liquefying and freezing during operation and tendency to wash out lubrication; (b) acids, due to their corrosive action, and (c) solids, due to their abrasive action.

Water vapors are present in the air in proportions varying with the surroundings, temperature and pressure. Pure air is hygroscopic, hence in moist regions air under the same conditions of temperature and pressure will contain more water vapor than in dry regions. Under normal conditions of temperature (60 deg. F.) and pressure (14.7 lb. per sq. in. or barometric pressure 29.9 in. of mercury) air contains 0.00088 lb. water vapor per cu. ft. and is said to be saturated; when it contains less than half this amount it is said to be dry.

The following illustrations (fig. 1 and 2) show better than long descriptions and tables could do the influence of temperature on the weight of water vapor per cubic foot of saturated air at atmospheric pressure, i. e., 14.7 lb. per sq. in. (fig. 1) and of the influence of pressure on the weight of water vapor per cu. ft. of saturated air at 60 deg. F. (fig. 2).*

Solid impurities in the air vary and depend mostly on atmospheric conditions and surroundings.

The kind and amount of acids in the air depend strictly on local conditions such as contamination from chemical and metallurgical plants.

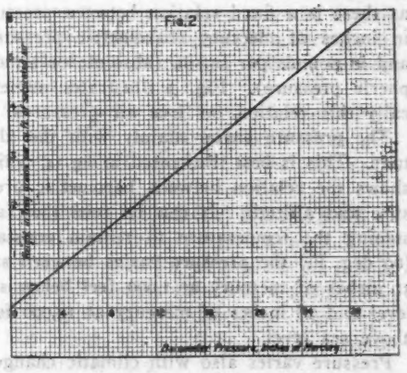


Fig. 2—Relation between barometric pressure and weight of moisture in saturated air at 60 deg. F.

Quite much, although not enough, air conditioning is being done to improve the quality of the air which is used as food for the human machine, but practically nothing is yet done to purify the air fed to mechanical machines. Manufacturers and users of air power machinery know well the difficulties resulting from the presence of moisture and other impurities in the "free" air. The amount of these impurities per cu. ft. may seem to be small, but considering the vast amounts of air used the cumulative ratio is exceedingly detrimental.

Pure air is needed for mechanical machines just as well as for the human machine.

Pressure, Weight and Volume of Air

The pressure, weight and volume of free air, i. e., the air such as it is encountered in nature in habitable climates and before being subjected to any mechanical action such as

*Sir William Ramsay stated in his "The Gases of the Atmosphere," that pure air, i. e., the air freed of its impurities, contains also the rare gases in the following proportions:

Helium—1 part in 245,300 parts by volume
Krypton—1 part in 20 million parts by volume
Neon—1 part in 80,800 parts by volume
Argon—1 part in 106.8 parts by volume
Xenon—1 part in 170 million parts by volume

and that air also contains radio-active gases, the one best known being Niton which is the radium emanation.

*Due consideration will have to be given to the facts that the amount of air per cu. ft. varies with temperature and pressure, as will be shown below.

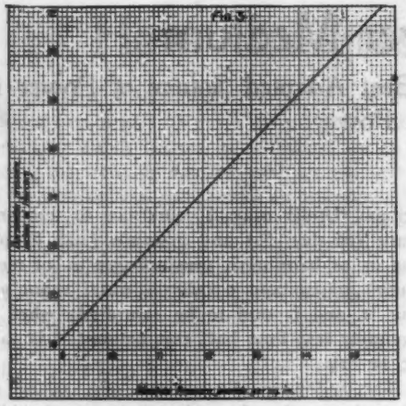


Fig. 3—Relation between barometric pressure, inches of mercury, and absolute (atmospheric) pressure pounds per sq. in. mean temperature of air 60 deg. F.

heating, compression or vacuum, do not have well defined and unique values, but values varying with climatic conditions such as temperature and altitude.

Pressure of Air—Experience has shown that at 60 deg. F. and at sea level (altitude zero) the pressure exerted by the air is normally say 29.9 in. of mercury or 14.7 lb. per sq. in. These two ways of expressing the air pressure might lead at first to some confusion, but in reality they convey the same thing, as there is a fixed relation between pressure in inches of mercury (barometric pressure) and in pounds per sq. in. (absolute or atmospheric pressure). Fig. 3 illustrates numerically this relation for free air pressures.

The pressure varies mainly with the altitude. This is best illustrated in fig. 4, which shows the relation between barometric pressure and altitude. It can be seen that, assuming the temperature to remain constant (60 deg. F.) the pressure varies between say 31 inches of mercury at 1,000 feet below sea level and 18 inches of mercury at 14,000 feet above sea level.

Pressure varies also with climatic changes,

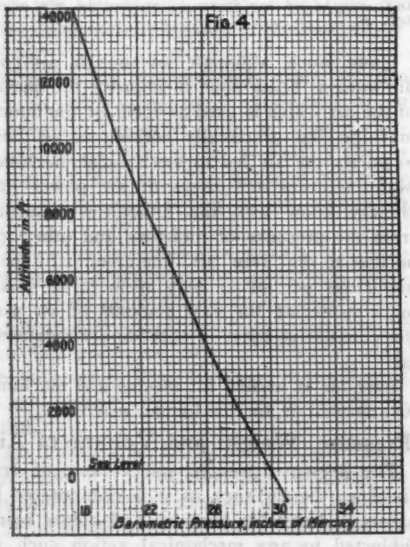


Fig. 4—Relation between altitude in feet and barometric pressure in inches of mercury (60 deg. F.).

but these variations are temporary and strictly local, and do not represent normal conditions.

Weight of Air—The weight of a unit volume of free air is not a well defined constant. It varies with the variations in temperature and barometric pressure. Thus, under normal conditions of temperature, (60 deg. F) and pressure (29.9 in. of mercury or 14.7 pounds per sq. in.) at sea level the weight per cu. ft. of air can be taken as 0.076 lb. but a difference in temperature or pressure, or in both will give greatly different values per cu. ft. This is best shown in the diagrams figs. 5 and 6.

Fig. 5 illustrates the variation of the weight per cu. ft. of free air when the temperature varies between 0 deg. F. and 100 deg. F. (temperatures encountered in habitable regions), with the assumption that the baro-

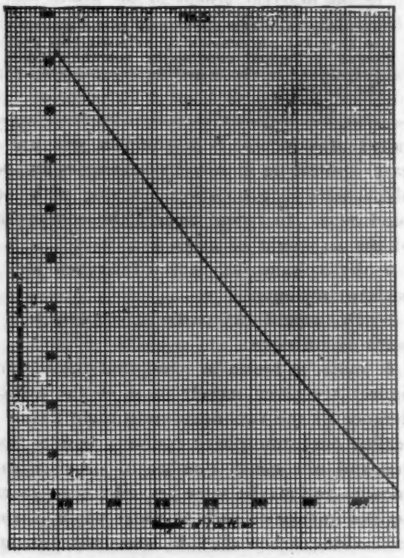


Fig. 5—Relation between weight per cu. ft. of free air and temperature, at constant pressure 29.9 in. mercury.

metric pressure remains constant (29.9 in. of mercury). It can be seen that the weight per cu. ft. varies between say 0.0864 lb. at 0 deg. F. and 0.0710 lb. at 100 deg. F.

Fig. 6 illustrates the variation of the weight per cu. ft. of free air when the barometric pressure varies between 18 and 31 inches of mercury (pressures encountered in habitable regions) with the assumption that the temperature remains constant. (60 deg. F.) It can be seen that the weight per cu. ft. varies between say 0.0460 lb. at 18 in. of mercury and 0.0790 lb. at 31 in. of mercury.

When both temperature and pressure vary the weight per cu. ft. varies in well defined proportions, and considering only the above stipulated limits of temperature and pressure, the weight per cu. ft. of free air can vary between say 0.0460 lb. and 0.0864 lbs.

Volume of Air—The volume of a unit weight of free air varies with the variations in temperature and barometric pressure. Under normal conditions of temperature (60 deg. F.) and pressure (29.9 in. of mercury) at sea level, the volume of 1 lb. of air can be taken

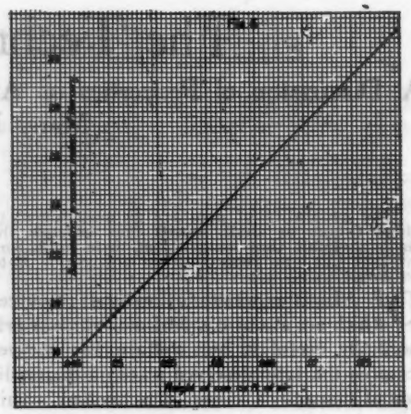


Fig. 6—Relation between weight per cu. ft. of free air and pressure, at constant temperature (60 deg. F.).

to be 13.09 cu. ft., but a difference in temperature or pressure or in both will give greatly different values for the volume of 1 lb. of free air. This is best shown in the diagrams fig. 7 and 8.

Fig. 7 illustrates the variations of the volumes per lb. of air when the temperature varies between 0 and 100 deg. F. (temperatures encountered in habitable regions) with the assumption that the barometric pressure remains constant at 29.9 in. of mercury. It can be seen that the volume per lb. varies between say 11.58 cu. ft. at 0 deg. F. and 1409 lb. at 100 deg. F.

Fig. 8 illustrates the variation of the volume per lb. of free air when the barometic pressure varies between 18 and 31 inches of mercury (pressures encountered in habitable regions) with the assumption that the tempera-

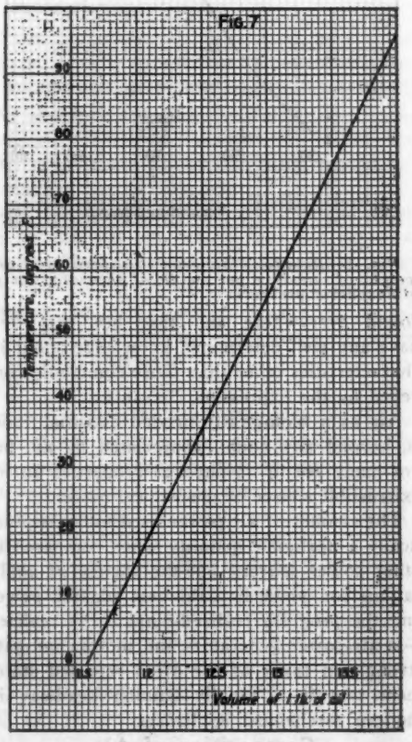


Fig. 7—Relation between volume per pound of free air and temperature, at constant pressure (29.9 in. mercury).

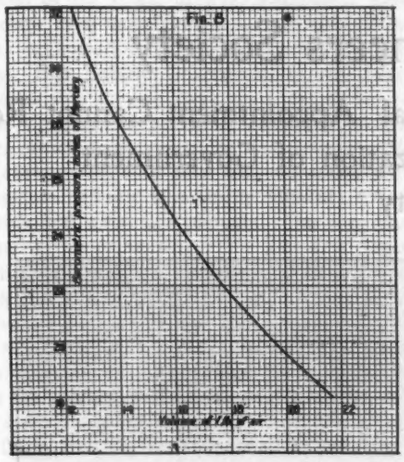


Fig. 8—Relation between volume per pound of free air and pressure, at constant temperature (60 deg. F.).

ture remains constant (60 deg. F.). It can be seen that the volume per lb. varies between say 21.70 cu. ft. at 18 in. of mercury and 12.60 cu. ft. at 31 in. of mercury.

When both temperature and pressure vary the volume per lb. varies in well defined proportions and in considering only the above stipulated limits of temperature and barometric pressure for free air the volume per lb. varies between 11.58 and 21.70 cu. ft.

Altitude, Weight and Volume Relationship

Not enough attention is being paid by quite a great number of users of air-power machin-

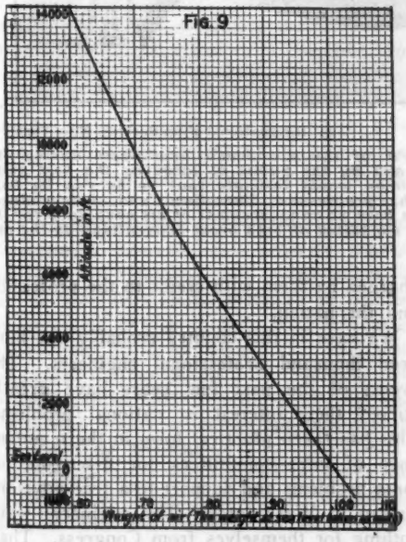


Fig. 9—Relation between altitude and weight of air per unit volume the weight at sea level taken as unity (60 deg. F.).

ery to the influence of altitude on the weight and volume of their free air. The diagrams fig. 9 to 12 are given to illustrate clearly, and in a way better than long descriptions and tables could do, this influence. Thus, fig. 9 shows that assuming the weight of a unit volume of free air (60 deg. F.) at sea level is being taken as unity, the weight of the same unit volume of air (60 deg. F.) at an altitude of 14,000 ft. above sea level would be only say 0.6. Similarly fig. 10 shows that assuming the volume of a unit weight of free air (60 deg. F.) at sea level is being taken as unity, the volume of the same unit weight of air (60 deg. F.) at an altitude of 14,000 ft. above sea level would be 1.7.

Fig. 11 and 12 show respectively the variations in the weight per cu. ft. and volume per lb. of free air due to variations of altitude with the assumption that the temperature remains constant (60 deg. F.).

Air as a Source of Power

In the foregoing dealing only with free air it has been shown that it possesses to a very high degree the valuable properties of fluidity,

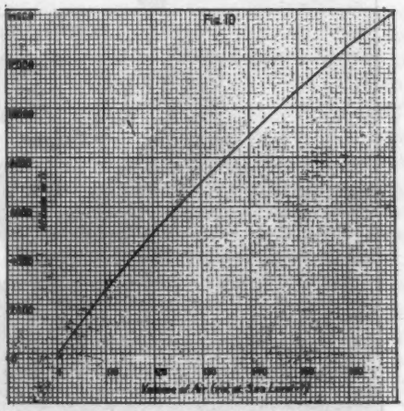


Fig. 10—Relation between altitude and volume of air per unit weight, the volume at sea level taken as unity (60 deg. F.).

elasticity and compressibility. These properties are markedly apparent even for the relatively very small differences in the naturally usual temperatures and pressures. By analyzing the diagrams it can be seen that there exist well defined relations between temperature, pressure and volume, and that by changing one of these factors, changes in the others are bound to follow.

If instead of having the cycle of changes limited to merely natural happenings we do increase manifold the change in any one or even two of the above factors, the resulting change manifested in the others would also be manifold. Mechanically, it is relatively very easy to vary the temperature by thousands of degress F. and the pressure between thousands

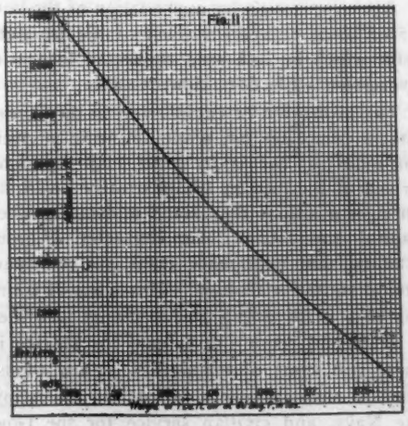


Fig. 11—Relation between weight per cu. ft. of air and altitude (60 deg. F.).

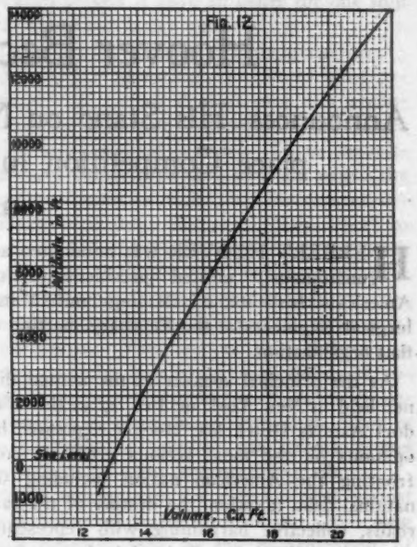


Fig. 12—Relation between volume per pound and altitude (60 deg. F.).

of atmospheres (1 atmosphere equals 14.7 lb. per sq. in.) and thousands of an atmosphere and even up to what is taken to be nearly perfect vacuum.

Air power technology is based on the mechanical realization of the cycle of changes in the factors, temperature, pressure and volume, and its fundamental theoretical principles are summarized in well defined relations between these factors.

[The next article on The Fundamental Principles of Air-Power Technology will be published in a subsequent issue.—*The Editors.*]

AIR MACHINERY EXPORTS

The Bureau of Foreign and Domestic Commerce has provided for publication the following table of exports from the United States of air compressing machinery, by countries, in the last month for which records are available, December, 1919.

Countries	*Dollars*
Belgium	42,510
France	62,910
Italy	29,742
Netherlands	28,994
Russia in Europe	60,800
Spain	4,713
Sweden	1,597
England	37,103
Canada	26,725
Costa Rica	986
Nicaragua	496
Mexico	9,009
Jamaica	414
Other British West Indies	84
Cuba	15,569
Argentina	12,621
Brazil	738
Chile	13,930
Ecuador	131
Peru	158
British India	7,231
Straits Settlements	55
Dutch East Indies	415
Hongkong	75
Japan	21,144
Australia	7,094
New Zealand	812
Other British Oceania	11
French Oceania	5
Philippine Islands	8,105
British South Africa	3,634
Italian Africa	2,570
Egypt	50
Total	400,938

The compressed air plant on the south side of St. Johns River bridge, Jacksonville, Fla., was damaged to the extent of $3,000 by fire.

Hoover Becomes President of Engineers Society

Announces His Stand on Nation's Greatest Problems—Political Appointment Cannot Replace Competition in Selection of Ability—Overcentralization of Government and the Human Factor in Productivity

HERBERT HOOVER was nominated and unanimously elected president—of the American Institute of Mining and Metallurgical Engineers at the February meeting of that organization.

As the principal speaker at the annual dinner held in New York on Feb. 17 at the Waldorf Astoria Hotel, Mr. Hoover expressed his opinions on the most serious problems confronting the American nation including the national debt, taxation, the destiny of the railroads, collective bargaining with representatives of employees, a Federal budget system, and the possibility of radicalism controlling the United States.

In thus defining his attitude toward the paramount questions involving the affairs of his country which he did in an unusually definite and comprehensive manner regarding constructive measures for affording relief from national ills resulting from the great war, Mr. Hoover studiously avoided introducing any political flavor into his remarks. It seemed apparent, however, that his outline of proposed remedies to hasten the convalescence of the country, industrially, socially, financially and in the economical administration of governmental affairs, was palpably the platform on which he would like to stand in the event of his nomination by either of the two great political parties.

Mr. Lawrence Addicks, the prominent metallurgical engineer introduced Mr. Hoover to the assembled mining engineers, many of whom had travelled from the far distant mining districts of Colorado, Arizona, Nevada and other Western parts, accompanied by members of their families. Conspicuous among the guests, was a generous sprinkling of representatives of the fair sex lending color and brightness to the setting which otherwise would have possessed an atmosphere of formal dignity so apt to be present in a gathering of men accustomed to the solution of weighty engineering projects.

In introducing the new president the toastmaster said that Mr. Hoover had been introduced as everything from St. Herbert of Palo Alto to the next president of the United States which remark was greeted by the audience with uproarious applause. At least they made it obvious that Mr. Hoover as the next occupant of the White House would certainly be acceptable to the mining fraternity. Continuing Mr. Addicks said: "Mr. Hoover, you are welcomed here tonight by as many as can crowd into one room on behalf of some eight thousand of your professional associates, and in choosing you as the president of the American Institute of Mining and Metallurgical Engineers, they are tendering you the highest honor in their gift, and on their behalf, I greet you this evening and present you to this audience as Herbert Hoover, American Mining Engineer."

© International Film Service, New York.

A recent photograph of Herbert C. Hoover, "ablest of the president's lieutenants during the war," who is being much talked of by both parties and by the public at large as the best qualified man to succeed to the Presidency. Popular opinion would intimate that he be run by both parties, embodying as he does, in his acts and speech, progressive liberalism and independence from party influence and control. Though there has been no announcement of his candidacy for the office, it is popularly rumored, that his name will be suggested at both great conventions as the one man best fitted for the post.

Mr. Hoover's Speech

After expressing his appreciation of the honor of being elected president of the Institute, with which he had been connected his entire professional life Mr. Hoover said:

The profession of engineering in the United States comprises not alone scientific advisers on industry, but is in great majority comprised of the men in administrative positions. In such positions they stand midway between capital and labor. The character of your training and experience leads you to exact and quantitative thought. This basis of training in a great group of Americans furnished a wonderful recruiting ground for service in these last years of tribulation. Many thousands of engineers were called into the Army, the Navy, and civilian service for the Government. Thousands of high offices were discharged by them with credit to the profession and the nation.

We have in this country probably one hundred thousand professional engineers. The events of the past few years have greatly stirred their interest in national problems. This has taken practical form in the maintenance of joint committees for discussion of these problems and support to a free advisory bureau in Washington. The engineers want nothing for themselves from Congress. They want efficiency in government, and you contribute to the maintenance of this bureau out of sheer idealism.

Even more than ever before is there necessity for your continued interest in this vast complex of problems that must be met by our Government. We are faced with a new orientation of our country to world problems. We face a Europe still at war; still amid social revolutions; some of its peoples still slacking on production; millions starving; and therefore the safety of its civilization is still hanging by a slender thread.

Out of the strain of war, weaknesses have become even more evident in our administrative organization, in our legislative machinery. Our Federal Government is still overcentralized, for we have upon the hands of our Government enormous industrial activities which have yet to be demobilized. We are swamped with debt and burdened with taxation. Credit is woefully inflated; speculation and waste are rampant. Our own productivity is decreasing. Our industrial population is crying for remedies for the increasing cost of living and aspiring to better conditions of life and labor. But, beyond all this, great hopes and aspirations are abroad; great moral and social forces have been stimulated by the war and will not be quieted by the ratification of peace.

Competition in Selection of Ability

The war nationalization of railways and shipping are our two greatest problems in Government control awaiting demobilization There are many fundamental objections to continuation of these experiments in socialism necessitated by the war. They lie chiefly in their destruction of initiative in our people and the dangers of political domination that can grow from governmental operation. Beyond this, the engineers will hold that the successful conduct of great industries is to a transcendent degree dependent upon the personal abilities and character of their employees and staff.

No scheme of political appointment has ever yet been devised that will replace competition in its selection of ability and character. Both shipping and railways have today the advantage of many skilled personnel, sifted out in the hard school of competition, and even then the Government operation of these enterprises is not proving satisfactory. Therefore, the ultimate inefficiency that would arise from the deadening paralysis of bureaucracy has not yet had full opportunity for development. Already we can show that no government, under pressure of ever-present political or sectional interests, can properly conduct the risks of extension and improvement, or can be free from local pressure to conduct unwarranted service in industrial enterprise. On the other hand, our people have long since recognized that we cannot turn monopoly over to unrestrained operation for profit, nor that the human rights of employees can ever be dominated by dividends.

Our business is handicapped on every side by the failure of our transportation facilities to grow with the country. It is useless to talk about increased production to meet an increased standard of living in an increasing population, without a greatly increased transport equipment. Moreover, there are very great social problems underlying our transport system. Today their contraction is forcing a congestion of our population around the great cities, with all that these overswollen settlements import. Even such great disturbances as the coal strike have a minor root in our inadequate transportation facilities and their responsibility for intermittent operation of the mines.

The return of the railways to the owners places predominant private operation upon its final trial. If instant energy, courage, and large vision in the owners should prove lacking in meeting the immediate situation we will be faced with a reaction that will drive the country to some other form of control. Energetic enlargement of equipment, better service, co-operation with employees, and the least possible advance in rates, together with freedom from political interest, will be the scales upon which the public will weigh these results.

The Shipping Problem

Important phases of our shipping problem that have come before you should receive wider discussion by the country. As the result of war pressure, we will spend over $2,800,000,000 in the completion of a fleet of 1,900 ships, comprising a great total of 11,000,000 tons—nearly one-quarter of the world's cargo shipping. We are proud of this great expansion of our marine, and we wish to retain it under the American flag. Our shipping problem has one large point of departure from the railway problem, for there is no element of natural monoply. Anyone with a water-tight vehicle can enter upon the seas today, and our Government is now engaged upon the conduct of a nationalized industry in competition with our own people and all the world besides. While in the railways Government inefficiency could be passed on to the consumer, on the seas we will sooner or later find it translated to the national Treasury.

Until the present time, there has been a shortage in the world's shipping, but this is being rapidly overtaken, and we shall soon be met with fierce competition of private industry. If the Government continues in the shipping business, we shall be disappointed from the point of view of profits; for we shall be faced with the ability of private enterprise to make profits from the margins of higher cost of Government operation alone. Aside from those losses inherent in bureaucracy and political pressure, there are others special to this case. The largest successfully managed cargo fleet in the world comprises about one hundred and twenty ships, and yet we are attempting to manage 1,900 ships at the hands of officials of a Government bureau.

When we consider giving orders for new ships, we must at the same time consider the sale of ships, as we cannot go on increasing this fleet. When we consider sale, we are confronted with the fact that our present ships were built under expensive conditions of war, costing from three to four times per ton the pre-war amount, and that already any merchant, subject to the long time of delivery, can build a ship for seventy-five per cent. of their cost. It would at least seem good national policy to sell ships today for the price we can contract for delivery a year or two hence, thus making the Government a reservoir for continuous construction. We could thus stabilize building industry to some degree and also bring the American-owned fleet into better balance, if, as the Government sold three or four emergency-constructed cargo vessels it gave an order for one ship of a better and faster type.

Concentration of Administration

Our joint engineering committees have examined with a great deal of care into organization of and our expenditure on public works and technical services. These committees have consistently and strongly urged the appalling inefficiency in the Government organization of these matters. They report to you that the annual expenditure on such works and services now amounts to over $250,000,000 per annum, and that they are carried out today in nine different Governmental departments. They report that there is a great waste by lack of national policy of co-ordination, in overlapping with different departments, in competition with each other in the purchase of supplies and materials and the support of many engineering staffs.

They recommend the solution that almost every other civilized government has long since adopted, that is, the co-ordination of these measures into one department under which all such undertakings should be conducted and controlled. As a measure practical to our Government, they have advocated that all such bureaus should be transferred to the Interior Department, and all the bureaus not relating to these matters should be transferred from the Interior to other departments. The committee concludes that no properly organized and directed saving in public works can be made until such a regrouping and consolidation is carried out, and that all of the cheeseparing that normally goes on in the honest effort of Congressional committees to control departmental expenditure is but a tithe of that which could be effected if there were some concentration of administration along the lines long since demonstrated as necessary to the success of private business.

Another question of Government organization to which our engineers have given adhesion is in the matter of the national budget. To minds charged with the primary necessity of advance planning, co-ordination, provision of synchronizing parts in organization, the whole notion of our hit-or-miss system is repugnant. A budget system is not the remedy for all administrative ills; it provides a basis of organization that at least does not paralyze administrative efficiency as our system does today. Through it, the co-ordination of expenditure in Government departments, the prevention of waste and overlapping in Government bureaus, the exposure of the pork barrel, and the balancing of the relative importance of different national activities in the allocation of our national income can all be greatly promoted. Legislation would also be expedited. No budget that does not cover all Government expenditure is worth enactment.

The Human Factor in Productivity

Another great national problem to which every engineer in the United States is giving earnest thought, and with which he comes in daily contact, is that of the relationship of employer and employee in industry. In this, as in many other national problems today, we are faced with a realization that the science of economics has altered from a science of wealth

to a science of human relationships to wealth. We have gone on for many years throwing the greatest of our ingenuity and ability into the improvement of processes and tools of production. We have until recently greatly neglected the human factor that is so large an element in our very productivity. The development of vast repetition in the process of industry has deadened the sense of craftsmanship, and the great extension of industry has divorced the employer and his employee from that contact that carried responsibility for the human problem. This neglect of the human factor has accumulated much of the discontent and unrest throughout our great industrial population and has reacted in a decrease of production. Yet our very standards of living are dependent on a maximum productivity up to the total necessities of our population.

I am daily impressed with the fact that there is but one way out, and that is to again reestablish, through organized representation, that personal co-operation between employer and employee in production that was a binding force when our industries were smaller of unit and of less specialization. Through this, the sense of craftsmanship and the interest in production can be re-created and the proper establishment of conditions of labor and its participation in a more skilled administration can be worked out. The attitude of refusal to participate in collective bargaining with representatives of the employees' own choosing is the negation of this bridge to better relationship. On the other hand, a complete sense of obligation to bargains entered upon is fundamental to the process itself.

The interests of employee and employer are not necessarily antagonistic; they have a great common ground of mutuality, and if we could secure emphasis upon these common interests we would greatly mitigate conflict. Our Government can stimulate these forces, but the new relationship of employer and employee must be a matter of deliberate organization within industry itself. I am convinced that the vast majority of American labor fundamentally wishes to co-operate in production and that that basis of good will can be organized and the vitality of production re-created.

Coal Industry Functions Badly

Many of the questions of this industrial relationship involve large engineering problems, as an instance of which I know of no better example than the issue you plan for discussion tomorrow in connection with the soft-coal industry. Broadly, here is an industry functioning badly from an engineering and consequently from an economic and human standpoint. Owing to the intermittency of production, seasonal and local, this industry has been equipped to a peak load of twenty-five or thirty per cent over the average load. It has been provided with twenty-five or thirty per cent larger labor complement than it would require if continuous operation could be brought about. I hope your discussion will throw some light on the possibilities of remedy. There lies in this intermittency not only a long train of human misery through intermittent employment, but the economic loss to the community of over a hundred thousand workers who could be applied to other production, and the cost of coal could be decreased to the consumer.

These are but few of the problems that confront us. But in the formulating of measures of solution, we need a constant adherence to national ideals and our own social philosophy.

In the discussion of these ideals and this social philosophy, we hear much of radicalism and of reaction. They are, in fact, not an academic state of mind but realize into real groups and real forces influencing the solution of economic problems in this community. In their present-day practical aspects, they represent on one hand roughly various degrees of exponents of socialism, who would directly or indirectly undermine the principle of private property and personal initiative, and, on the other hand, those exponents who in various degrees desire to dominate the community for profit and privilege. They both represent attempts to introduce or preserve class privilege, either a moneyed or a bureaucratic aristocracy. We have, however, in American democracy an ideal and a social philosophy that sympathizes neither with radicalism nor reaction as they are manifested today.

Social Philosophy of America

For generations the American people have been steadily developing a social philosophy as part of their own democracy—and in these ideals it differs from all other democracies. This philosophy has stood this period of test in the fire of common sense; it is, in substance, that there should be an equality of opportunity—an equal chance—to every citizen. This view that every individual should, within his lifetime, not be handicapped in securing that particular niche in the community to which his abilities and character entitle him, is itself the negation of class. Human beings are not equal in these qualities. But a society that is based upon a constant flux of individuals in the community, upon the basis of ability and character, is a moving virile mass; it is not a stratification of classes. Its inspiration is individual initiative. Its stimulus is competition. Its safeguard is education. Its greatest mentor is free speech and voluntary organization for public good. Its expression in legislation is the common sense and common will of the majority. It is the essence of this democracy that progress of the mass must arise from progress of the individual. It does not permit the presence in the community of those who would not give full meed of service.

If we cling to our national ideals it will mean the final isolation and the political abandonment of the minor groups who hope for domination of the Government, either by "interests" or by radical social theories through the control of our political machinery. I sometimes feel that lawful radicalism in politics is less dangerous than reaction, for radicalism is blatant and displays itself in the open. Unlawful radicalism can be handled by the police. Reaction too often fools the people through subtle channels of obstruction and progressive platitudes. There is little danger of radicalism ever controlling a country with so large a farmer population, except in one contingency. That contingency is from a reflex of continued attempt to control this country by the "interests."

The mighty upheaval following the world war has created turmoil and confusion in our own country no less than in all other lands. If America is to contribute to the advance of civilization, it must first solve its own problems, must first secure and maintain its own strength. The kind of problems that present themselves are more predominantly economic—national as well as international—than at any period in our history. They require quantitative and prospective thinking and a sense of organization. These are the sort of problems that your profession deals with as its daily toil. You have an obligation to continue the fine service you have initiated and to give it your united skill.

TO HOLD AERIAL TOURS

In view of the interest in proposed aerial tours being shown in the United States and Latin American countries, an international congress to be held in Atlantic City, N. J., June 6th, at which aerial touring and navigation from every angle will be the topics for discussion, is being planned by the Aerial Touring Association, according to the announcement of the Aero Club of America.

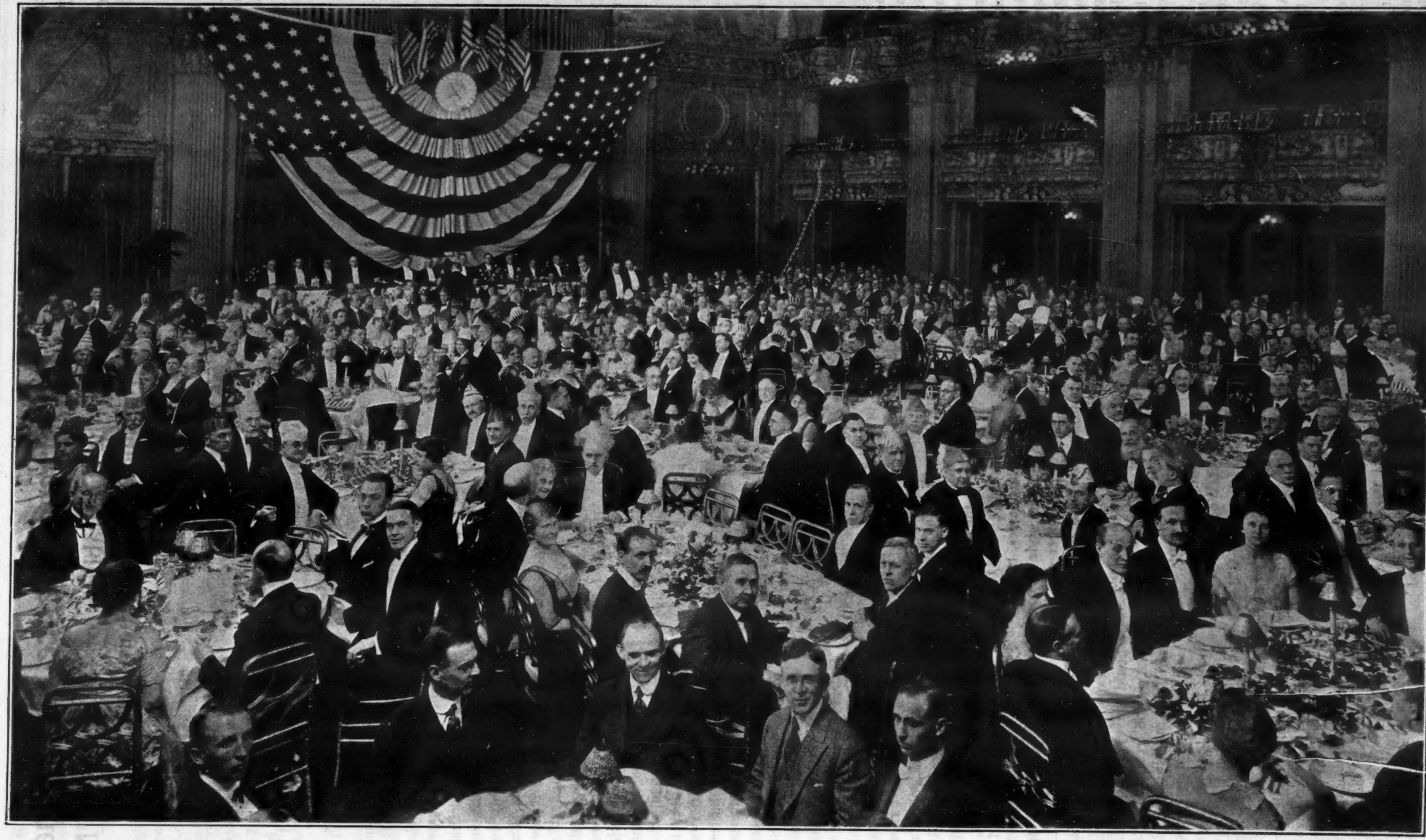
Aerial tours are being arranged to take place in June and continue weekly throughout the summer, the tours to consist of cross-country flights of from 250 miles to 3,000 miles, with stops, conducted on the same principle as the automobile tours.

The Atlantic City Steel Pier has been engaged for the congress and a trophy has been offered by Major Charles J. Glidden, president of the Aerial Touring Association.

STIRRING PAINT BY AIR

A writer in a recent issue of *Factory* calls attention to an important use of compressed air in large paint shops. Nearly all large plants, he says, have paint rooms of their own. Here is stored the paint supply of the whole factory. Because of the tendency of the paint to settle, it must be stirred up each time any quantity is withdrawn. As a rule, the stirring of paints by hand is done to the accompaniment of aching muscles and breaking backs. One good-size factory, however, performs the whole operation by the turn of an air-cock. There happens to be a high-pressure air supply handy to the paint room. Paint is kept in barrels each containing a double wooden paddle. When the paint requires stirring, a pneumatic reaming tool is slipped over the end of the paddle shaft which projects above the barrel top. This shaft is held in place by two crossed pieces placed across the barrel head. By using the shaft in place of a reamer shank, the paddle is whirled rapidly and the paint mixed in a surprisingly short time. After one barrel of paint is mixed thoroughly the reaming tool is slipped over the paddle shaft in the next barrel. Thus the whole job is done quickly and with little labor.

Annual Dinner of the American Institute of Mining and Metallurgical Engineers



© Deucker & Co., New York.

The annual dinner of the Institute at the Waldorf Astoria Hotel, New York, on Feb. 17, 1920, when Herbert Hoover made his inaugural address, was attended by 547 members and their wives and guests. Preceding the dinner a reception was tendered to Mr. and Mrs. Hoover and Mr. and Mrs. Horace V. Winchell. A dance was held after the dinner.

"Style" in Professional Correspondence of Engineers

An Educator—Engineer's Viewpoint on the Desirability of Professional Men Giving Dignity and Leisurely Atmosphere to Their Letters

By P. B. McDONALD

THE LETTERS of a professional man—a physician, an engineer, a teacher—should differ somewhat from the letters written by the average business-man. Although there are, of course, many exceptions to the rule, the professional man is more likely to be a college man than is the business-man. The professional man is supposed to show in his letters the marks of his education, and generally to indicate a dignified "professional" bearing and a temperament influenced as much by a desire to add to the world's knowledge as by the pursuit of gain.

The professional man does more or less work in research and "pure science" for the good of his profession. He is, of course, not averse to making a profit, but he does not bend everything to that end as does the business-man. Incidentally, this is one of the reasons why the professional man has been relatively losing ground in the matter of compensation for his services during the last several years. It is the reason why teachers, editors, pharmacists, etc., are underpaid and overworked. It is the reason why college students have been parading in different parts of the country carrying such signs as "Feed the Prof." and "A Professor Works on his Stomach."

Yet it would be a calamity indeed if professional men went too far in commercializing their efforts. It would lessen the discoveries in science, lower the confidence we like to feel in a physician or engineer, and spoil the human element in the teacher and minister. There is something to be said for the ethics and traditions of the professions,—for the impracticableness of the researches and student. Imagine a physician who advertised in vivid colors on bill-boards, or an engineer who built a flimsy bridge to skimp a profit, or a minister always thinking of his remuneration for a funeral. It is obvious that a professional man should be swayed by a point of view somewhat different from that of the business-man "on the make," to whose activities Adam Smith's dictum of supply and demand and the itching palm still hold good.

American business-men have some of the finest qualities imaginable, are often unsung heroes, and deserve praise and appreciation that they do not always get. Yet the gingery, "get-there" attitude which the more extreme types assume is sometimes over-done. The 'New York Times' recently printed the protest of a South American writer named Albuquerque against the more superficial and "slap-dash" variety of North American advertising, which gives offense to the dignity and traditions of high-class Latins.

A European criticism of American business style complained that a letter from New York or Chicago, is too likely to run in this vein:

> "You are a business-man; your time means money. You cannot afford to waste it by fooling around after low-grade stuff. It is up to you to get the best. You can get it, and get it quick, from Jones & Co. Why? Because Jones & Co. specialize in mind-saving. Jones & Co. have studied this thing out. They know that you need your brains for live work, not for worrying over back numbers."

This style of letter is, of course, familiar to everyone; most of us have received waste-paper baskets of such "live-wire" exhortations and commands, frequently re-enforced by a picture of a vigorous man pointing his finger straight at the reader!

Another European stricture on American business methods bewailed the advance of the "art of salesmanship," because, with "the system in the saddle," complained this conservative, one eats imitation jam in which even the seeds have been made by machinery to give an appearance of naturalness to the product.

Such protests as these apply only to the more frothy of American businesses, but they serve to illustrate why a business style of correspondence is not exactly the proper one for professional men to imitate. What then should be the style of a professional man's letters? Sweeping aside temporarily all political prejudices, it can be said that the most extreme example of a professional-letter writer (some sarcastic people might say professional letter-writer, a significant shift of the hyphen) well known to the public is Woodrow Wilson.

Making due allowance for Mr. Wilson's diplomatic vagueness and political oratory (what one Senator called "soufflee of soap-bubbles"), his letters have the dignity, moderation, and flowing smoothness that should characterize—though perhaps in a less degree—the letters of the typical professional man. The following note of the President, consisting of only two sentences, is in the best professional style:

> "My dear Senator:
>
> Matters of so grave a consequence are now under consideration that I would very much appreciate an opportunity to have a talk with you about the treaty and all that it involves. I wonder if it would be possible for you to see me at the White House at 2.15 o'clock to-morrow, Thursday afternoon.
>
> Cordially and sincerely yours,
>
> (Signed) *Woodrow Wilson.*"

Or it is pertinent to take as illustration the President's 200-word message on prohibition:

> "I am convinced that the Attorney General is right in advising me that I have no legal power at this time in the matter of the ban on liquor. Under the act of November, 1918, my power to take action is restricted. The act provides that after June 30, 1919, 'until the conclusion of the present war and thereafter until the termination of demobilization, the date of which shall be determined and proclaimed by the President, it shall be unlawful,' etc. This law does not specify that the ban shall be lifted with the signing of peace, but with the termination of the demobilization of the troops, and I cannot say that this has been accomplished. My information from the War Department is that there are still a million men in the army, under the emergency call. It is clear, therefore, that the failure of Congress to act upon the suggestion contained in my message of the twentieth of May, 1919, asking for a repeal of the act of Nov. 21, 1918, so far as it applies to wines and beer, makes it impossible to act in this matter at this time. When demobilization is terminated, my power to act without Congressional action will be exercised.
>
> *Woodrow Wilson.*"

Like these letters of President Wilson, the correspondence of an engineer or physician should convey a certain leisureness of thought, such as the treatment of an illness or the design of a machine should receive. The style ought to suggest long views, a careful judgment, a thoughtful manner, while still containing underlying strength and forcefulness. No one need use such long sentences as President Wilson favors, unless he wishes to, of course. Such excellent writers as Abraham Lincoln and Georges Clemenceau prefer short, logical, and pithy sentences. The French incline to mathematically short and precise sentences, based on their prevalent philosophy of rationalism. The British naturally adopt long sentences and are not averse to wandering from the main thought if the side-paths seem

THE designing engineer on machinery jobs who corresponds with clients for his house, the engineering salesman; in fact, all men who are classified as being in "professional" vocations as contrasted with hard-and-fast business pursuits, should give heed to their epistolary style. P. B. McDonald, Assistant Professor of English in the School of Applied Science of New York University, reads a lecture in this article to our "professional" readers.

As indicative of the increasing interest engineering companies are taking in the use of correct and dignified English, it is pertinent to note that the Western Electric Company is considering the formation of classes in English for its graduate engineers. An ordinary command of English is not "good enough." Professor McDonald's article will indicate why.

interesting. Many British writers cultivate a certain sonorousness of phrase, and it must be admitted that their journalists, for instance, construct more impressive sentences than the somewhat careless prose common to American newspapers.

In striving for a dignified, thoughtful style suggestive of an educated man not entirely preoccupied with dollar-chasing, the professional man by all means should avoid the pompous manner of the many verbose writers who evidently have never heard of that sterling rule, "eliminate the superfluous word." As a case in point, the following sentence from an engineer's letter, can be reduced to the better form shown:

> "The reason why I desire a change of position is due to the fact that in a larger concern my chances for advancement undoubtedly would be better."

Reducing this 27-word sentence to 16 words gives the simpler and better sentence:

> "I wish a change because with a larger company my chance for advancement would be better."

This is a 40% reduction and saves that much effort for the reader. It gives point to the remark of Charles A. Dana, as reported in *System* for October, that he had time to write a long letter but not time to write a short one. While it is not true that a 40% reduction in words can be made often, it is probably true that a 20% reduction would improve most letters, making them simpler, more moderate, and truer. The wording, however, should not be so reduced as to give an aspect of telegraphic abruptness. Equally as important as the omission of superfluous words is the desirability of making a letter smooth and flowing in diction, as illustrated in President Wilson's style.

The professional man should be even more careful than the business-man in the matter of using words in their exact meanings and in not using certain over-worked words too much. He should choose such words as "quite," "line," "concern," "desire," "due," etc., only for their proper and limited meaning. He should avoid the undue use of such words as "so," "as," "advise," and the participles and superlatives.

Everything considered, the professional man has reason to be particularly careful in his employment of language. As an intellectual leader, and a man of judgment and taste, he has high traditions to maintain. His choice of words and literary style are often taken as criterion of his professional skill and character.

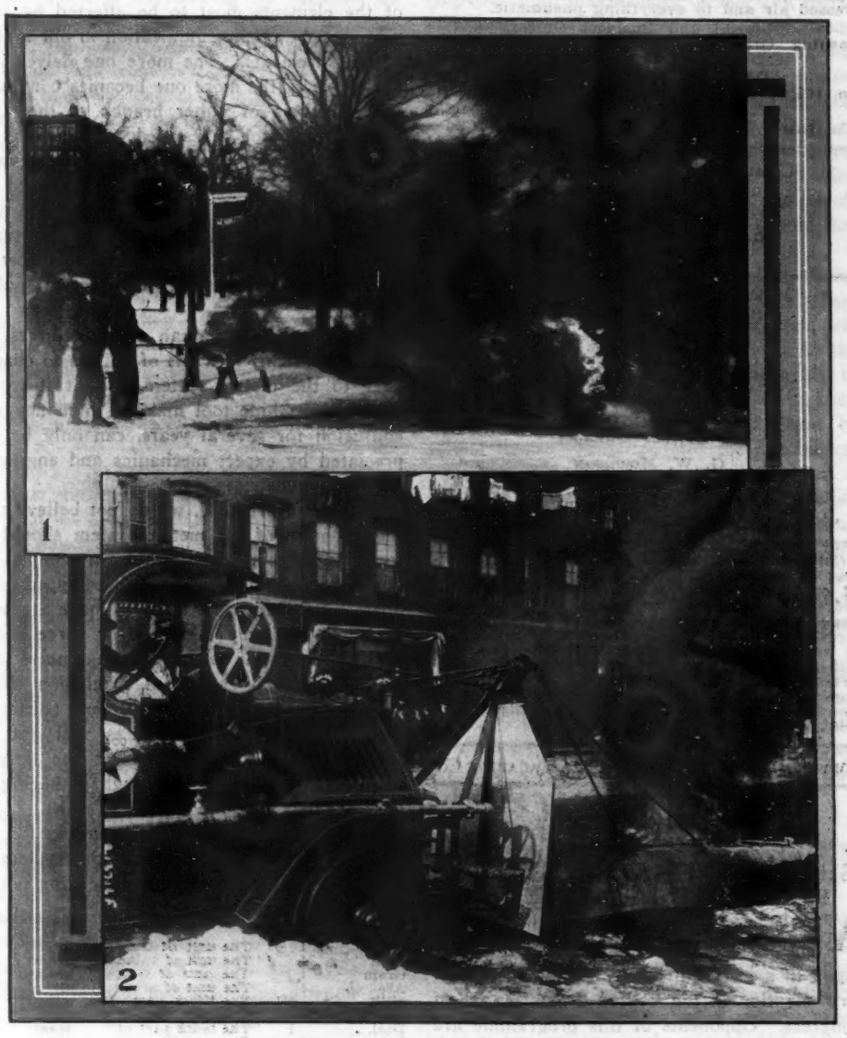
SOCIETY TO DEVELOP IDEAS OF U. S. INVENTORS

The National Laboratory Foundation was recently organized at a convention of inventors in the Hotel Astor, New York, for the purpose of developing American inventive genius. The following resolution was adopted:

"To secure and establish the ultimate right of the public to its heritage of intellectual property. Therefore, be it resolved, The object of the National Laboratory Foundation is to assist in the just and proper development of American inventions and industry by selecting, developing, testing and advancing the use of meritorious inventions to benefit the public, the inventor and the manufacturer and safeguard the interests of all."

The board of governors includes the following: Thomas Howard, executive chairman, an automobile and motion picture engineer; Professor W. H. Burr, former member of the Isthmian Canal Commission; Professor Charles F. Chandler, Columbia University; Dr. Charles P. Steinmetz, General Electric Company; Simon Lake, submarine inventor; John Hays Hammond, Jr., and Dr. Lee De Forrest, wireless inventor.

Seeking Relief from Clutches of Snow Blockade



Views of Snow Melting Apparatus.

THE HEAVY SNOW falls in New York City in February, one following the other in almost daily recurrence, combined with the drop in temperature which froze the layer of slush in the streets and avenues into a solid dense mass, were the cause of practically paralyzing the transportation of a great city.

Among the many solutions offered to remedy this serious condition which New York had suddenly been precipitated into without warning, is one which is shown in the accompanying illustrations. The method proposed by the Chemical Warfare Department consisted in the use of a flame thrower similar to that used in the trenches. The upper illustration shows a test being made at Columbus Circle, near the entrance to Central Park. The flame thrower threw the flames 160 feet. The lower illustration shows L. V. Stevens, inventor of the automobile snow melter which according to reports was used successfully on the Canadian Pacific Railway, giving a demonstration at Avenue C and 17th Street, Brooklyn. This apparatus travels five miles an hour. The pipes shown extend in front and crude oil from an 1800-gal. tank, mounted on the auto truck, is forced through these pipes to the burner. A small compressor furnishes the compressed air for atomizing the oil.

Compressed Air Magazine

—Founded 1896—

Devoted to the mechanical arts in general, especially to all useful applications of compressed air and to everything pneumatic.

Editorial and Business Offices:
Bowling Green Building, No. 11, Broadway, New York City, U. S. A.

Office for the British Isles:
No. 165, Queen Victoria Street, London, E. C. 4.

Cable Address:
"Compaire", New York. Western Union Code.

COMPRESSED AIR MAGAZINE CO.
PUBLISHERS

WILLIAM LAWRENCE SAUNDERS
President

FRANCIS JUDSON TIETSORT
Editor and General Manager

EUGENE P. MCCRORKEN
Managing Editor

FRANK RICHARDS
Technical Editor

WALTER C. LAROS
Circulation Manager

G. W. MORRISON
Treasurer

ARTHUR D. MCAGHON
Secretary

Correspondence invited from engineers, chemists, experimenters, inventors, contractors and all others interested in the applications, practice and development of compressed air. Correspondents and contributors will please submit questions, or matter for publication, accompanied by self-addressed stamped envelope; they also will please preserve copies of drawings or manuscripts as we cannot guarantee to return unavailable contributions in the event of rejection, though our practice is to exercise diligence in doing so.

Editorials

SHALL THE METRIC SYSTEM BE FORCED ON AMERICA?

ADVOCATES of the so-called metric system of weights and measurements are engaged in a strong drive to cause its compulsory adoption in the United States by act of Congress. Opponents of this programme are announcing with just as much force from factory and house-tops that industrially and otherwise we are extremely likely to rue taking any such step without conservative deliberation. It is a subject upon which every manufacturer, every railroad official, every mining man, and every person engaged in interstate or foreign commerce should inform himself, for sooner or later a decision in the controversy must be reached.

Thoughtful persons upon reading the continuous rain of propaganda put forth by the World Trade Club of San Francisco, and after reading the countering views and arguments of the America Institute of Weights and Measures, of New York, and the individual views of representative American engineers and manufacturers, to say the least will not wish to see a federal law hastily "jammed through." It is a subject that requires deep thought and study and a comprehensive summing up of the best arguments on both sides of the question.

COMPRESSED AIR MAGAZINE believes that a national commission should be selected to deliberate the question with great care before any legislative action is attempted. There should be painstaking judgment exercised in the formation of such a commission, in order that its personnel will faithfully represent all of the elements most to be affected by such a proposed sweeping innovation in our system of measurements. The more one delves into the question, the more one becomes convinced that members of either branch of the Congress should not be carried off their feet by letters and telegrams incited by propaganda. That sort of "backing" can be engineered for almost any sort of proposal under the sun, as any experienced legislator or politician can testify! In many instances this sort of testimony does not reflect general public sentiment.

It will cost American manufacturers, to start with, many millions of dollars to change over to the metric system. What it would mean to machine tool makers, in money and confusion for several years, can only be appreciated by expert mechanics and engineers in these industries.

As a fixed proposal, we do not believe that the adoption of the metric system should be forced upon manufacturers by a compulsory law; certainly not until a well-equipped commission has had opportunity to make a report. It would probably take two or three years' time for such a commission, engineers say, to reach a well calculated conclusion either for or against the metric system. Glittering generalities and catch phrases will not do. Such a commission must effect the desired result through a most thorough gathering of evidence.

Proponents of metric measurements for the United States seek to explain the system in the following table, and the succeeding notes:

Name	Value	Meaning	Pronounced	Ab
Meter	1	"The unit of length"	meeter	m.
Liter	1	"The unit of volume"	leeter	l.
Gram	1	"The unit of weight"	gram	g.
Are	1	"The unit of area"	air	a.
Milli.	.001	"The 1000th part of"	milly	m.
Centi.	.01	"The 100th part of"	senti	c.
Deci.	.1	"The tenth part of"	dessy	d.
Deka	10	"Ten times"	decka	dk.
Hecto	100	"100 times"	heckto	h.
Kilo	1,000	"1000 times"	killo	k.

When the meaning of these 10 words is known THE WHOLE METRIC SYSTEM is learned. The tables of derived units form themselves automatically, and there are no tables to be memorized; 90% of humankind, for practical purposes, need not learn all these names. All they need is to know METER, LITER, GRAM, all, like the dollar, used decimally.

Meter for length 10% longer than the yard. Why not call it "world yard"?

Liter for bulk, 5% more than the U. S. liquid quart and 13% less than the British liquid quart. Why not call it "world quart"?

Gram for weight, 500 grams being 10% more than a pound avoirdupois. Why not call 500 grams "world pound"?

The World Trade Club of San Francisco, some of the literature of which seems to have an almost *Mittel Europa* flavor, prints in its *Weekly Metergram* the following from Washington:

> The new secretary of the Department of Commerce, J. W. Alexander, is an efficient exponent of Meter-Liter-Gram, and has sent the following message under date of December 18 to the World Trade Club, San Francisco:
>
> "It has seemed to me for years past that we should have a uniform standard of weights and measures, recognized and used by all nations and especially those having intimate commercial intercourse. In the recent world war all movements of troops were measured and expressed in terms to the Metric System and it was with no little difficulty that the average reader translated them into miles, yards and inches, and I am in sympathy with your efforts and favor the adoption of the Metric System as a universal system."
>
> Secretary of Commerce Redfield who preceded Alexander in this important post but recently, was also an efficient advocate of Meter-Liter-Gram, and was one of the first public men to send in his indorsement to those who are fighting for adoption of the metric units. Meter-Liter-Gram advocates are delighted to learn that Redfield's successor is in as hearty accord with them.

Mr. HENRY R. TOWNE, of the Yale & Towne Manufacturing Company, sometime president of the American Society of Mechanical Engineers, prepared a paper presented at the annual meeting of the society in New York in December, 1906, entitled, *Our Present Weights and Measures and the Metric System.* We have for consideration a booklet containing a reprint of this paper from the *Proceedings of the Society,* and find the dissertation of Mr. TOWNE constitutes "an appeal for the appointment of a national commission to consider the whole subject." So the commission idea is not new. On the other hand, neither are the efforts of the advocates of the metric system, who have persistently sought to obtain its compulsory adoption.

President MADISON brought up the matter in 1816 in a message to the Congress. Just half a century later the Congress legalized the use of metric measurements, and it has since been taught in our schools. The development of modern science, especially in the field of electricity, has necessitated the creation of many new measures, usually based on metric units. It will be seen that any present use of metric measurements, therefore, is lawful, but not compulsory. Fourteen years ago Mr. TOWNE asked:

"Is it not time that the vitally important questions thus involved should be studied by a competent technical tribunal, whereby a decision may be reached, which being based on due consideration of all the conflicting issues involved, shall be acceptable to all our people, and therefore, permanent?"

We believe, fourteen years later, that the question is still to be answered in the affirmative. No member of the Congress should take a fixed stand on the metric controversy until he has familiarized himself with the contents of Mr. TOWNE's treatise, we are also convinced.

One may now approach a consideration of the latest contribution to the general subject, a book by FREDERICK A. HALSEY, Commissioner of the American Institute of Weights and Measures, of No. 115, Broadway, N. Y. City, entitled *The Metric Fallacy,* which embodies an investigation of the claims made for the metric system and especially of the assertion that its adoption is necessary in the interest of export trade.

The motto of the book is axiomatic, undeniable:

> Truth wears no mask, bows at no human shrine, seeks neither place nor applause; she only asks a hearing.

If Mr. HALSEY's views and researches constitute truth, there will certainly be no compulsory adoption of the metric system in the United States! Our national solons can not afford even to commit themselves on the metric system until they have had the fairness to absorb the contents of this book. Even

members of the "World Trade Club" should open-mindedly peruse its pages!

The book prints as a frontispiece before its title page a quotation:

"Experience has shown—even if the people soon forget the lesson—that any general threat of arbitrary regulation of private lives goes unheeded until too late. People think it incredible, but it comes, just as war, which men believed could not come again, came with sudden destructiveness."

It might have mentioned the Eighteenth Amendment!

After reading the HALSEY book, four chapters of which were prepared by Mr. SAMUEL S. DALE, we doubt whether any fair-minded person can conscientiously declare that the shouters for the metric system have thus far made out a case that will hold water. This volume indicates first of all that it would be exceedingly difficult, if not impossible, to change over to metric weights and measures. Even those countries that have tried it, have in large measure failed. There is confusion and open rebellion. The experiment has not succeeded in France after 112 years of effort and 70 years of compulsory law! French manufacturers and exporters continue to use the old units when they think it expedient. Quotations from leading business houses in all lines, together with the replies made to numerous *questionnaires*, and a further perusal of other chapters on the metric system's use in manufacturing, in engineering and in science, should serve to open the eyes of those seeking all the facts.

A complimentary chapter is devoted, by the way, to the World Trade Club and its present publicity methods, which governmental authorities will do well to read.

Every intelligent person with an open mind is forced to the conviction that the metric measurement idea should not, and must not, be seriously proposed even, until it has been the subject of a most exacting and searching inquiry by technical, not political, experts. And while we are at it, why not investigate the motives actuating the present fabricated hue and cry for its *immediate* adoption? What, too, are the antecedents of its most voluble champions? Have they themselves been misled? Has *import* trade in certain lines anything to do with the subject?

SECRETARY LANE IN AND OUT OF A CABINET POST

THERE HAS been real regret expressed throughout the nation over Secretary FRANKLIN K. LANE, of the Department of the Interior, taking leave of his place in the Cabinet. If Mr. LANE was to be regarded as one of the strongest personalities in President WILSON'S administration, and this was general opinion, he was also one of the most interesting, picturesque and active figures at Washington.

Several years of service as a member of the Interstate Commerce Commission, which would take the measure of any man, followed by his cabinet experience, made Mr. LANE one of the most familiar figures in America's public life. He was earnest and hard working. He always knew *what* he wanted and then *went after it*. Fairly radiating optimism, he was habitually energetic, in speech and in written word, in forwarding the interests of what he made a great crusade, the development of the United States of America by the utilization and conservation of its vast resources in power and in materials.

In directing his portfolio, Mr. LANE was quite as close to business interests of America, in one sense, as was his former *confrere*, Mr. REDFIELD, Secretary of Commerce, who had left public service four months earlier. And it is declared smilingly at Washington that negotiators of business having to do with Mr. LANE'S department never found him a lump of putty in their hands!

The late Mr. E. H. HARRIMAN, one of America's men of great genius in railroading, had a high opinion of Mr. LANE'S powers of analysis and on his grasp of transportation problems. His earlier legal training and his familiarity with the complex subject of transportation facilities, fitted in neatly with the duties of his office as supervisor and custodian of the nation's natural wealth. Lumbermen, power producers, mining men and oil operators have had reason to pronounce a respectful estimate upon the calibre of the man, for in his cabinet post he worked with both intelligence and zeal.

At this writing, it is announced that the retiring secretary is to step into a post paying $50,000 a year, four times the emolument accruing to a cabinet officer, as vice president and legal advisor of the Pan-American Petroleum & Transport Company and the Mexican Petroleum Co. He will there become actively and closely associated with Mr. E. L. DOHENEY, president of these two companies, a strong man who has forged his way to the front in the oil arena.

Mr. LANE will be an almost invaluable aid to these interests, but while his friends are glad of the business opportunity which he has grasped, they feel regret from a standponit of public policy that so well trained and zealous a government official should be lost to the service of his fellow citizens.

One of the greatest and most virile American public documents of recent years was his last report as Secretary of the Department of the Interior. Every business man and every national legislator should read that masterly summary and analysis by the hard working administrator, the broad and dynamic man, who has had the gift of making at least his part of the public's business of consuming interest to 110,000,000 people. Were each member of the House and Senate at Washington fully conversant with the details of that report, both bodies would know infinitely more about their own country than they have ever dreamed, and they would be fortified to legislate more intelligently for the nation. Every business and professional man, every industrial producer, should preserve a copy of it as a classic dissertation on America's storehouse of natural wealth.

Mr. LANE'S labors in connection with post-war reconstruction will long be remembered. His opening speech as chairman of last autumn's gathering of the National Industrial Conference was admirable. His suggested remedies for unrest were hard work, increased production, maintenance of law and order, and a calm faith in American institutions. How salutary and sane a view. Practically everything said publicly since on the subject has been reiteration of his wise counsel. He declared:

"There can be no revolution in a democracy such as ours, because we had a revolution which placed sovereign power in the hands of the people, and once for all we passed that gate."

Mr. LANE was born in 1864 in that quaint sea-bound spot, Prince Edward Island, where the silver fox of commerce is propagated, and where the automobile is in disfavor. At the age of three he was taken to California to live by his father, a clergyman. Had he been born by the Golden Gate, he might now be among those "mentioned" for the Presidency.

Among those actually born on this soil it would be exceedingly difficult to find a more aggressive, more loyal or more useful American. He will be remembered as a public official for the personal qualities just noted and for his facility in making the facts respecting our stores of coal, copper and waterpower of vivid and picturesque significance.

COMPRESSED AIR MAGAZINE, which has had occasion closely to observe his work in connection with the Bureau of Mines, extends its felicitations to Mr. LANE and wishes him success and conservative usefulness in his new endeavors.

SODDY'S NEWEST THEORY ON LIMITLESS ATOMIC FORCE

THE WORLD of scientific thought is rapidly drifting toward natural sources of free power, numerous considerations of which have appeared in these columns in months past. The Lee Professor of Physical Chemistry at Oxford has lately advanced the latest contribution to the subject in a book in which he makes some rather startling predictions. Inasmuch as Professor SODDY is noted for his study of the characteristics of various elements, with particular reference to radium and its cognates, weighty interest will attach to his observations. He writes that:

Discoveries in radioactivity have shown that in the smallest atoms of matter all around us there exist stores of energy a million times greater than any so far harnessed. Limitless physical power awaits humanity as soon as knowledge that shall lead to its control and application has been obtained. How many unrecorded ages elapsed before the energy of fuel was controlled and in how short a space of subsequent time has it altered the whole mode of life of the world. Given a clear course, and that most rare of national qualities, common sense, physical science can abolish the 'struggle for existence so far as concerns food and fuel."

Professor SODDY incidentally is one of those holding to the belief that the moon cannot really be extinct and dead. He declares that in the present state of physics it is impossible

to conceive of a physically dead world; that is to say, "a world without any available source of energy.

An interesting dispatch to *The New York Times* from London quoted Professor SODDY as having much to say of queer elements and the strange atoms of alchemists' age-old dreams of turning base metal into gold. He thought there was nothing extravagant in such dreams.

The elements can be transmuted into one another, or could be if the atoms in them could be varied slightly. "To get gold from mercury," he says, "expel from the atom of mercury one betaparticle which will make thallium, then one alphaparticle which will turn thallium into gold, or to get gold from lead expel from one atom of lead one alphaparticle, which will turn into mercury and proceed as before."

Europe needs gold to pay its war debts. Lead is comparatively cheap and so is mercury—but is chemistry ready yet to undertake the amelioration of the plight of international debtors.

JAMES GAYLEY, ASSOCIATE OF CARNEGIE, DIES

James Gayley, a noted metallurgist and first vice-president of the U. S. Steel Corporation during the years from 1901 to 1909, passed away at his home in New York on the twenty-fifth day of February, his loss being sincerely felt by his associates in the great steel industry which he had helped to build from its early infancy and fellow members of scientific bodies in which he took an unusual degree of interest.

Born in Lock Haven, Penn., in 1855, he graduated as a mechanical engineer from Lafayette in 1876 and assumed the duties of chemist with the Crane Iron Works, later accepting a position as superintendent with the Edgar Thompson Steel Works of the Carnegie Steel Co. Thus did Mr. Gayley become associated with the famous iron master, becoming one of the coterie of men who were later to be popularly referred to as "Carnegie's boys." He was soon promoted to managing director of the Carnegie Company holding that position until 1901 when he assumed full charge of shipping and transportation for the U. S. Steel Corporation.

Mr. Gayley was a profound student of the art of steel metallurgy in which he always had a most intense interest. His enthusiasm led him to establish the Gayley Laboratory of Chemistry and Metallurgy at Lafayette in 1902 and last year he gave a donation of $20,000 for enlarging Gayley Hall.

Mr. Gayley evidenced a distinct mechanical trend even in early boyhood which supplemented by his later engineering training made him a pioneer in the advancement of iron and steel metallurgy. It was during his association with the development of steel production in which his inventions were of essential importance that this industry expanded into its commanding position and was the basis of the great industrial era which was to follow.

Notable among these inventions was his introduction of the first compound condensing blowing machinery for blast furnaces, bronze cooling plates for blast furnace walls and an auxiliary casting stand for Bessemer steel plants. He found time during his very active career to contribute many professional papers on metallurgical topics to scientific journals and he received the distinguished honor of election to the presidency of the American Institute of Mining and Metallurgical Engineers.

The news of his death was received with feelings of sadness by the college community at Lafayette of which he was a trustee and by his fellow members of the University, Metropolitan and Engineers' Clubs. Mr. Gayley is survived by his three children, the Countess Giulio Senni of Rome, Mrs. Gerrish H. Milliken and Miss Florence Galey, of New York.

Reconstruction Days

Of 1,986 French industrial concerns devastated by the war 1,385 had resumed operations, either in part or in full, on November 1, 1919, as against 1,278 on September 1 and 835 on August 1. Of the personnel in these factories in 1914, 23.1% had returned by last November. The proportion of returning workers shows a rapid increase month by month. The textile industries particularly show a returned personnel of 32.9 per cent. The highest proportion has been reached in the woolen industry, with 48.2 per cent. returned.

Announcement has been made of the names of members of the national committee which will supervise the erection of a statue at Meaux, France—the point on the Marne which was reached by the Germans in their advance on Paris in 1914—as a gift from America to France in commemoration of the gallant stand which was made by Joffre's armies. The statue, which is to be almost as large as the Statue of Liberty, will be the work of Frederick Macmonnies. The cost will be approximately $250,000. The committee will not conduct a campaign for funds, but will appoint State chairmen to oversee the raising of the amount by voluntary subscriptions in all parts of the country.

Secretary Daniels has asked Congress to prohibit exportation of helium, the non-inflammable gas used for filling military balloons and dirigibles.

The United States has produced more than 61 per cent. of the world's crude petroleum since the discovery of that product, and at latest reports was producing more than 69 per cent. of the world's annual supply.

Excess of American exports over imports in 1919 amounted to $4,017,000,000, a new record. Exports for 1919 totalled $7,922,000,000.

The annual report of the Department of Mines of New South Wales for 1918, issued in October, 1919, shows a total value of mineral products of the State from its beginning to the end of 1918 of $1,460,559,057. Values of minerals produced in 1918 are as follows: Coal, $24,017,182; lead and zinc, $27,894,014; copper, $3,385,379; tin, $2,667,537; gold, $1,796,951; iron, $1,701,000. Molybdenite, wolfram and sundry metals bring the total production for 1918 to $70,078,051. The number of persons engaged in mining in New South Wales in 1918 was estimated at 33,815, of which 17,000 were employed in mining coal and shale. The estimated value of the machinery and plants in operation is $17,722,495 for metalliferous mines and $11,362,280 for coal and shale mines .

Mexico stood first as the source of copper ore, for the year 1919, sending 57,376,307 pounds worth $10,577,393 to the United States, more than doubling the shipments of 28,201,213 pounds worth $5,222,768 sent by Canada which ranked second. Chili was third among the countries shipping ore to America with 15,800,966 pounds, valued at $3,037,342, but led in manufactures of copper consigned to the United States, sending 89,859,898 pounds worth $20,980,104. Peru followed Chili as a source for copper manufactures, shipping a total of 80,829,505 pounds valued at $15,406,844.

Contents for April

Book Reviews

MECHANICAL EQUIPMENT OF BUILDINGS, a reference work for engineers and architects, in two volumes, by LOUIS ALLEN HARDING, B. S., M. E., and ARTHUR CUTTS WILLARD, S. B. Vol. I, Heating and Ventilation; Vol. II, Power Plants and Refrigeration. First Edition; second impression, corrected. Illustrated with many figures and folding plates. Price, flexible bindings, Vol. I, (621 pps.) $4; Vol. II, (766 pps.) $5. New York; Messrs. John Wiley & Sons, Inc. London: Messrs. Chapman & Holl, Ltd.

THESE TWO BOOKS are from the pleasant shades of Urbana, the well spring of considerable engineering literature of the day, and since the time of their first printing in 1916 they have become standard works in designing room literature on the mechanical equipment of building. They deal not only with the heating and ventilation of buildings, considered in the first volume, but in the second part, cover fully the subjects of power plants, elevators, lighting systems, refrigeration plants, sprinkler systems, vacuum cleaning, and plumbing. They are chock full of data, theoretical and commercial, for practical use.

The authors have drawn upon all available sources of information relating to this field of information, and they have also made free use of manufacturers' data on mechanical systems of plants. No apology is made for this, as Messrs. Harding and Willard feel, quite properly no doubt, that references to specific makes of such equipment have not been intended as in any sense exclusive of other equipment of the same sort, but merely indicate that the equipment mentioned and described is as satisfactory as any offered in the market.

In the second volume are contained interesting graphs and tables on water, steam and air, following a treatise on physical units and the measurement of heat. Among other subjects treated in the second book are: Units Employed in Refrigeration Practice, Methods of Producing Artificial Refrigeration, Cold Air Machines, Compression Machines, Vacuum Machines, Ammonia Condensers, Brine Circulating Systems, the Ammonia Absorption Machine and Ice-Manufacturing Plants.

These suggestions as to some of the contents will indicate to our readers that may be unfamiliar with the books, the scope and value of these twin volumes, which comprise a work that engineers, architects and general building contractors can ill afford to be without.

PROPERTIES OF STEAM AND AMMONIA, by G. A. GOODENOUGH, M. E., Professor of Thermodynamics, University of Illinois. With tables, Mollier diagrams, etc. Second edition, 126 pps. Price $1.25. New York: Messrs. John Wiley & Sons, Inc. London: Messrs. Chapman & Hall, Ltd.

PROFESSOR GOODENOUGH observes in his preface that a table of the thermal properties of a vapor should possess two characteristics, consistency and accuracy. A table is thermodynamically consistent when the tabular values are obtained from equations that are properly connected by the necessary thermodynamic relations, such as the Clausius and Clapeyron relations; it may be considered accurate if the calculated values show satisfactory agreement with trustworthy experimental data.

The author holds that the older tables of the properties of steam were neither consistent nor accurate. The tabular values were calculated from empirical formulas based chiefly on Regnault's data, and the necessity of consistency was not recognized. Two sets of tables, he points out, have been based on the general theory developed by Callendar. These are absolutely consistent, but in the light of the knowledge acquired from the Munich experiments, they can no longer be regarded as accurate. In certain tables that have appeared in the last few years have been embodied the results of the Munich experiments, and also the researches of Dr. Davis on the total heat of steam. These tables are undoubtedly far more accurate than the earlier tables, but, having a more or less empirical basis, they are not rigorously consistent.

The tables of the properties of saturated and superheated steam presented in Professor Goodenough's book are based on a new formulation, the essential features of which are discussed in the first section of this highly technical volume. A more complete exposition will be found in Bulletin No. 75, Engineering Experiment Station, University of Illinois. The new theory correlates perfectly the experiments on the volume and specific heat of superheated steam; it gives values of the heat content of saturated steam that agree with those deduced by Davis from the throttling experiment; and, in general, it meets satisfactorily all the tests furnished by the available experimental evidence. The tables derived from the formulation are necessarily consistent, and at the same time are accurate.

The tables of the properties of ammonia are based upon a formulation worked out by W. E. Mosher and Professor Goodenough. (Bulletin No. 66, E. E. S., Univ. of Illinois). Since in the case of ammonia, the experimental evidence is far from completed, the formulation is regarded as only tentative, and the tables, the author admits, will perhaps require revision as further experiments are made.

The book contains several supplementary tables. One on mixtures of air and water vapor will be found especially useful in connection with problems that involve hygrometric conditions.

STEEL AND ITS HEAT TREATMENT, by DENISON K. BULLENS, consulting metallurgist. Profusely illustrated with photographs, drawing and charts, and containing index, and, in this second revised edition, appended chapters on high speed steels. 483 pps. Price, $4. New York: Messrs. John Wiley & Sons, Inc. London: Messrs. Chapman & Hall, Ltd.

BULLENS ON STEEL, is so well known an authority that the second edition of this standard work on heat treatment, now in its seventh thousand, scarcely needs consideration respecting its acceptability. This department aims to cover generally technical works in most of the mechanical fields, but as its first concern is with those books in this periodical's peculiar province, we are sometimes a pace behind our neighbor journals in giving deserved consideration to even the most highly important technical volumes. Regular readers of this department will recognize, however, our hearty appreciation of worthy works when time and space permit us to reach a consideration of them, and we trust we may be forgiven any seeming delinquencies, provided we do not pass by books before the passage of time and the march of progress have caused them to lose their greatest momentary value.

The second and revised edition of *Steel and Its Heat Treatment*, to which we gave a preliminary notice in these columns last month, and which will be found more valuable than its predecessor because of the author's appended materials covering high speed steel, bears the publication imprint of 1918, and is as nearly indispensable in its field as any such technical work can be said to be.

Steel mill men will join with Mr. Bullens in his estimate of modern heat treatment as an art or trade, since it certainly requires knowledge, skill and judgment for its proper performance. These, in turn, necessitate at least some knowledge of heat, of steel, and of the effect of heat upon steel. All three factors are linked together by the "human element." The author endeavors to bring the theoretical and practical sides together so they may be understandable by the human element.

In the fourth chapter of his book Mr. Bullens warns steel producers and others engaged in forging, etc., that the importance of the human element, too, cannot be too highly estimated, "even though the average present-day practice in many of the largest shops in the country indicates that it is not considered an important factor." He declares the man is the keynote to the situation and, at the same time, the weakest link in the chain. He is the cook or chef that puts the metallurgical finish on the material prepared at great expense by others, and it is his skill and exercise of judgment that determine the final result and either make or break the cycle of the operation.

Mr. Bullens cites the present-day cycle as something like this:

Skilled metallurgists and mechanics, with expensive plants and equipment, are employed to make a steel of suitable chemical composition. Then there are employed skilled engineers, draftsmen and mechanics with more expensive equipment, to shape and form it. The calculations of these men are based on the research of the metallurgists, who indicate the results to be expected from steel under proper heat treatments.

When all this labor and expense have been put into the manufacture and elaboration of the steel and it is ready for the metallurgical finishing touches, does it go to other skilled artisans, who, with proper equipment and knowledge of the results sought for, complete the final and all important operation?

The author answers his own question with a positive "No." As a rule, and investigation will show this to hold good in a large number of leading plants in the country, the work is entrusted to men who, as a matter of hard, cold fact, do not understand heating and whose knowledge seems to be limited to the extent of burning fuel, making a fire and watching a pyrometer. There is a mechanical check of some kind upon everything but the man that controls the heat-treatment operation.

In a book on the very subject of heat-treat-

ment it is small wonder our author features such a weakness. His words suggest that investigation in many other industries may divulge their weak human links in the chain of production and at critical points where they should be strongest!

The Bullens book will strengthen "weak links" in the process of heat-treatment of steel, for it is a highly practical treatise that may safely be commended and recommended.

POWER TRANSMISSION BY LEATHER BELTING, by ROBERT THURSTON KENT, Consulting Engineer; Junior, American Society of Mechanical Engineers. Illustrated and containing index tables and charts. First edition, 114 pps. Price, $1.25. New York: Messrs. John Wiley & Sons. Inc. London: Messrs. Chapman & Hall, Ltd.

KENT HAS TURNED out in this little volume a compact collection of valuable data for belting specialists and power transmission folk in general. The book is now in its fourth year, but this chances to be our first inspection of it. We find it a book that factory and shop men should have in reach on occasion.

The author comments on the advent of high-speed steel and of intensive methods of production as having rendered the problem of belt maintenance one of the most important of the many that the factory manager has to solve. In the machine shop belts must be proportioned to pull the heavier loads that are used in modern practice. In any industry the belts must be so taken care of that the interruption to manufacture due to belt failures will be reduced to the minimum. Interruptions to manufacture, of course, mean loss of production and loss of profits.

Most of the treatises on improved belting practice are buried in the transactions of the engineering societies, or must otherwise be obtained only through the files of contemporaneous technical journals. Even then this data is so scattered that it is difficult for the average man to comprehend that the art of power transmission by means of leather belting has completely changed in the last fifteen years. Mr. Kent has gathered together much of the best information on the new practice for the service of the belting user.

The shop engineer, master mechanic, or man in charge of shop belts will find the book a great aid to him as it contains information necessary to the proper selection of sizes in belts to transmit a given horsepower, the tension at which they should be operated, the length of time that should elapse between re-tightenings, and notes on the proper care and maintenance of belts. Information is also provided on the qualities of beltings, methods of using old belting, recipes for belt dressings, belting mathematics for shop use, together with much other downright practical data.

Associate Justice Bailey of the District Supreme Court signed a formal order of injunction against the U. S. Shipping Board to prevent the sale of 29 former German liners.

The Court consented to the request of the Shipping Board that the ship Suwanee, which has been sold for $2,000,000, be excluded from the order of injunction.

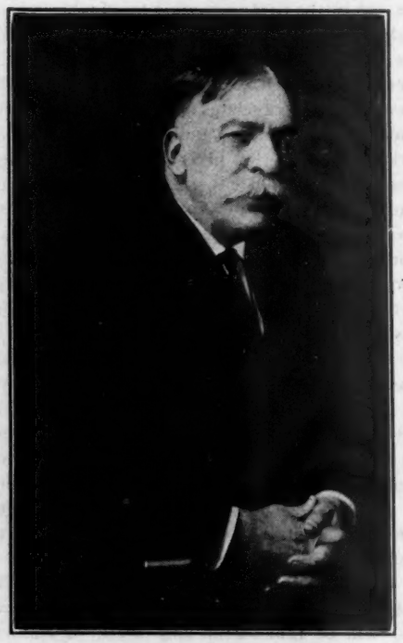
EDW. P. RIPLEY, PROMINENT RAILWAY MAN, DIES

EDWARD PAYSON RIPLEY, for many years a foremost figure among American railroad men and frequently referred to by them as "the grand old man" passed away recently at Santa Barbara, Cal., his death resulting from complications following an operation he underwent in Chicago several months ago.

Mr. Ripley was chairman of the board of directors of the Atchison, Topeka and Santa Fe Railroad, having resigned his position as president of the Santa Fe system last autumn.

In assuming the advisory post of chairman of the board, Mr. Ripley brought to an end, 24 years of distinguished leadership in the railroad field in the course of which he developed a bankrupt system into one of the finest transportation properties in the world.

It was on January 1, 1896, when the road



© Brown Brothers, New York.
Edward Payson Ripley.

was turned over to his guidance following a period of excessive expenditure and over extension of interests by Mr. Ripley's predecessors, that he commenced the application of conservative and systematic methods in solidifying the property which gradually resulted in bringing it to its present high level of efficiency.

Mr. Ripley was born in Dorchester, Mass., in humble circumstances. His father was a merchant whose yearly income never amounted to more than $600, but who gave his son a good, common-school education. It was while holding a subordinate position in a small dry goods house that Mr. Ripley was attracted to the railroad business by an increased salary. "I just happened into it" he frequently said in speaking of his railroad career to old friends many years afterwards.

At the age of 25 he was clerk for the Eastern Agent of the Chicago, Burlington and Quincy, and in the service of this road he rose steadily to important positions. His natural executive ability combined with his increasing railroad experience brought to him well deserved recognition and he rapidly advanced through the successive positions of New England agent, and General Freight Agent, then Traffic Manager and finally General Manager.

In 1890, he left the C. B. & Q., going to the Chicago, Milwaukee & St. Paul as third vice-president, and six years later he was called upon to assume the responsibilities of the presidency of the Santa Fe. Here his record was such that he was spoken of in 1918 as "the greatest living railroad man." His most noticeable characteristic was discipline and system, with which he combined an attractive personality which held unfailingly the loyalty of his subordinates. Mr. Ripley was always concerned for the welfare of his employees, his interest in them leading to a bonus of $2,750,000 being distributed in 1916 among all making less than $2,500 a year.

Mr. Ripley married Miss Frances E. Harding, a resident of his old home town in 1871. His home for many years was in Riverside, Ill., a suburb of Chicago, though he usually spent the winter in Southern California.

Personal Intelligence

Charles W. Plumb, who has been assistant superintendent of the Mammoth mine for several years, will be transferred on Jan. 1, by the U. S. Smelting, Mining & Refining Co., to Utah, where he will be superintendent of a mine belonging to the company.

* * *

Charles Keith Blackwood, vice-president, assistant treasurer, and a director of the Sullivan Machinery Co., died recently in Chicago. Mr. Blackwood's sound financial judgment, keen foresight, and executive ability, had been important factors in the Sullivan company's growth during the last seventeen years, where he was a valued associate and loyal friend.

* * *

George D. Kimball has been appointed member of the sub-coal committee, at Denver, of the Central Western region, representing the United States Fuel Administration. Subcommittee as follows has been organized at St. Joseph, Mo., with jurisdiction over terminals at that point: S. E. Stohr, chairman, and J. W. Bruce, the latter representing the United States Fuel Administration.

* * *

Reuben Edward Smith, an American mining engineer in Siberia, was drowned when his boat was overturned in the rapids of the upper Ulya river on the west coast of the Okhotsk Sea according to a recent report received in America and published in *Mining and Scientific Press*. Mr. Smith was born 45 years ago in the placer fields of California and resided at Vladivostok and in East Siberia for fifteen years. He received his early experience from his father in the construction of placer mining plants in California and Colorado.

Mr. Smith was in charge of coal mining operations in the Suchan district for several

years and afterward was engaged in the examination of gold-placer deposits in Korea and Siberia. From 1913 to 1916, he was in charge of the work of improving gold mining methods at the property of the Lenskoie Company in western Siberia. After the entrance of America into the war, he was engaged in the service of the Consular, Military Intelligence and War Trade departments.

* * *

Mr. George Weston, engineer, specialist in railway valuation work, died after a very brief illness. He was born in Kalamazoo, Mich., in 1861, and entered the engineering field at an early age. He became associated with Charles T. Yerkes in 1887 as engineer in charge of the Chicago Cable Car system. About a year ago, with his brother, Charles T. Weston, he organized and became president of Weston & Co., consulting engineers, associated with the Philadelphia Rapid Transit Company. He was a member of the American Society of Civil Engineers.

* * *

The Mesaba Iron Company has been organized with a capital of $3,000,000, to develop and work low grade iron deposits in the eastern portion of the Mesaba range.

Directors of the new company are Charles Hayden, chairman of the board; Daniel C. Jackling, president; John D. Ryan, W. E. Corey, Percy A. Rockefeller, C. M. McNeil, Sherwood Aldrich, W. H. Smith, Alva C. Dinkey, Seeley W. Mudd, Horace V. Winchell, K. R. Babbitt, W. G. Swart and J. C. Agnew.

* * *

E. J. David is in charge of the electrolytic refineries and silver department of the Raritan Copper Works, succeeding M. H. Merriss. Mr. David also takes Mr. Merriss' place as a member of the General Safety Committee.

* * *

John E. Hubbell, counsellor at law and solicitor of patents, formerly of Chambers and Hubbell, Philadelphia, announces that he has opened offices at 469 Fifth Avenue, New York, corner 40th street, where his practice will be devoted exclusively to patent and trade mark matters.

* * *

At the annual meeting of the Board of Directors of the Doehler Die-Casting Company, held at its main office, Brooklyn, N. Y., in January, the following officers were re-elected: H. H. Doehler, presdent; H. B. Griffin, vice-president; O. A. Schroeder, treasurer; O. A. Lewis, assistant secretary. J. Kralund, was made second vice-president, in charge of production, and Charles Pack, secretary and chief chemist.

* * *

The officers of the Arizona Chapter, American Mining Congress, re-elected at the annual meeting were: Norman Carmichael, governor, and G. M. Colvocoresses, F. W. Maclennan and John C. Greenway, vice governors. To the directorate, which has fourteen members, were added the names of W. S. Boyd, succeeding L. S. Gates, who has removed to Utah, and F. W. Maclennan, to succeed B. Britton Gottsberger.

Notes of Industry

Ingersoll-Rand Co. has changed the location of its offices from the ground floor of the Dooly Block, 210 S. W. Temple street, to rooms on the second floor of the same building.

Nevada Harmony Mines Company is beginning active development and mining of their property five miles out of Winnemucca, Nevada, under the management of G. B. Williams. Mr. Williams has recently purchased considerable equipment to equip the property, the principal machinery being a Venn Severin Oil Engine, an Ingersoll-Rand air compressor and Cameron sinking pump.

When methane is burned with insufficient air supply it burns with a yellow flame and deposits soot. Therefore, according to Bulletin No. 135 of the Bureau of Mines, natural gas, which consists mostly of methane, should be burned with some excess of air and with provision for obtaining a good burning mixture; otherwise soot will be deposited and gas will be wasted, owing to incomplete combustion. In this respect natural gas differs greatly from producer gas, the latter consisting mostly of carbon monoxide, which does not readily decompose.

The War Department, through the Division of Aeronautics, has renewed for another year its lease of the wind tunnel of the Massachusetts Institute of Technology. The tunnel has been of inestimable value in ascertaining the characteristics and pecularities of flying craft that could have been ascertained otherwise only by actual flights with their accompanying dangers. Experiments have been conducted in the tunnel on a model plan one-twenty-fourth of actual size.

The development of the manufacture of helium in America has established new records for celerity. When the United States entered the war there was but one cubic foot of helium in the possession of the Bureau of Mines. The plant quickly constructed at Fort Worth was able to turn out 5,000 cubic feet of 90 per cent. helium and by-products. The new plant, which will cost $2,000,000, will turn out 30,000 cubic feet of helium and supply some 7,200,000 cubic feet of the gas for dirigibles.

With the opening of the period during which Germany must pay her debts to the Allies, it is announced that the Commission on Reparation must fix the amount due by Germany before May 1, 1921. Meanwhile the commission will see that Germany carries out her obligations and until the sum the reparation payments amount to has been fixed, Germany will have to deposit $20,000,000,000 marks in gold, or its equivalent in material, ships, securities and coal.

The German government as a security for this portion of the debt, which is payable immediately, will be forced to hand over gold bonds representing the full amount. In addition to this, 40,000,000,000 marks of gold bonds immediately negotiable will be required and another sum of 40,000,000,000 marks in gold bonds, which will be negotiated as the commission shall consider the financial condition of Germany warrants.

The first electrically welded ship built in France was launched recently at Caen. It is to serve as a floating workshop for the *Societe Soudure Electrique Francaise.*

According to the *Chevrolet Bulletin* there are now 800,000 motor trucks in use in this country. They have displaced 2,000,000 horses. This has reclaimed 10,000,000 acres of land for the production of foodstuffs. In this way alone motor trucks have contributed greatly to the profit of farming.

From a purely transportation angle there are many other equally interesting phases. Allowing an average of ten tons a day to each truck, which is a very conservative figure, the 800,000 trucks in service will carry millions of tons of freight every day.

Besides furnishing the farmer with the means of reaching profitable markets the motor truck is assuming a vitally important position industrially, for a constantly increasing number of motor trucks are being used to carry raw materials to factories. The absence of this service rendered by these trucks would often mean that thousands of men would go idle for lack of the raw materials on which they work.

Charles Austin Hirschberg, Inc., advertising counselors specializing in the technical field, announces that they are now located in their permanent home, Nos. 426-436 Sun Building, 150 Nassau St., New York City. Telephone 2893. The officers are C. A. Hirschberg, presirent; W. B. Burn, vice president; H. C. Johnson, secretary, and H. L. Hicks, treasurer.

Copper imports into the United States in 1919 fell off by more than 30,000,000 pounds compared with 1918, according to reports at the Department of Commerce. During the past year 126,455,063 pounds of copper, valued at $23,541,020 were imported, against 157,216,481 pounds valued at $34,650,864 in 1918.

Copper exports slumped correspondingly, ore shipments for the year totalled 507,846 pounds at $95,930, compared with 2,387,275 pounds worth $578,165 in 1918. Refined copper exports decreased from 690,027,891 pounds in 1918 to 408,160,818 pounds last year, representing a decline in value of over $80,000,000. England was the chief market for American copper, taking a total for the year of 105,619,710 pounds worth $22,856,469.

Six high powered stations controlled by the Radio Corporation of America were taken over at the start of the war. They are at Marion, Mass.; New Brunswick and Tuckerton, N. J.; Bolinas and Marshall, Cal., and Kahuku, Hawaiian Islands.

Buenos Aires

EXTRA!

Our Moscow Correspondent Reports

Old pal "Tix," who is keeping an eye on the *Soviet* form of government in Moscow, sent a courier through Finland (we shall not say when) with reports for those whose interests he represents. Along with the courier came some observations and two Russian wheezes for *Buenos Aires!* A verbal and a written communication (the latter being on tiny sheets of cigarette paper) were delivered to us, let us say, in Chief Flynn's limousine in the centralest part of Central Park. In any event, Mac, the emissary, threw any *soviet* spies off the scent. We have taken a few liberties in rearranging Tix's material, which reads in the main, however about as follows:

DEAR BUENOS AIRES:—You may quite likely be able to guess that the compressed air machinery industry isn't any great shakes in sovereign *Soviet* Russia these days, but we are long on super-heated air. The proletariat spoutings and *ukases* have caused a great fatigue to settle upon me. Now you know yourself that despite my aristocratic bringing up and culture in the years when mother was the leader of the social whirl in ———, South Dakota, I have always been democratic at heart, and a bit underdone in even the *bourgeois* class. I have endeavored never to be an upstage, snobish upstart, but by all of Back Bay, Nob Hill, Grosse Pointe, North Shore Drive and Fifth Avenue, I believe I am becoming almost a royalist. If ever I get out of here and back to that dear, distant *Etats Unis* with a whole hide, I shall certainly burst forth with a book and unburden myself in a manner that will give the parlor bolsheviks pause. But of course this sort of stuff is not what you want for the Kol-yum.

* * *

A Russian friend of mine, formerly of the Petrograd Pneumatic Tool Company, who is now playing at being a bolshevik, so he can eat, tries occasionally to forget the drabness of his daily routine by sitting up at night with me over tall steaming glasses of tea, and cigarettes, and swapping yarns. He is a mixture of German, Yankee and Russian and I will say that he is some *raconteur* when it comes to stories about that element of the population which constitutes the pogromees in the times of pogroms. I have for you a couple that should convulse The Bronx, where Trotzky used to live a little more than three years ago when he was editing the *Novy Mir* down in St. Mark's Place:

Two gentlemen of Semitic strain from the vicinity of Vilna, met in the outer reception office of a "Russian" insurance broker—from Berlin. One asked the other what his business was, by way of time-killing conversation.

"I am an agriculturist," was the reply, "and what is your business?"

"Me? Oh, I am a shop keeper and sell goods. I am here to procure fire insurance on my wares. One can never tell."

The farmer thereupon volunteered the information that he was applying for insurance on his crops against hail.

The shop keeper was silent a time, apparently deep in puzzled reflections. He stuck out a judicial underlip and shook his head quizzically. Suddenly he cupped his hands over the farmer's ear and exclaimed in a stage whisper:

"But, my friend, tell me how you can make it *hail!*"

* * *

Now, my dear B. A., if you are inclined to sniff at that story and declare that it is merely a variation of the old-style original East Side fire insurance joke, please remember that the *original* structure of *that* one, which for so long has made the New York underwriter rock with glee in his swivel chair—while he reaches for his phone to notify the police—came out of Russia!

One more Hebraic pleasantry and I am done, or undone, especially if these little sheets of paper fall into Trotzky's hands. And believe me, old bean, the latter contingency would be no Ring Lardner!

Well, anyway, their names were Blatzky and Bronstein, if you will insist on "copy" being sprinkled with names. They were business partners who were familiar with, if not strict followers of the best elements of the Mosaic laws. Now while Blatzky and Bronstein swore by the hinges of the temple door that the interests of the one were those of the twain, they would occasionally hold out on each other in putting over some little private business deal carefully calculated to swell the exchequer of only one-half [illegible].

Blatzky had something up his sleeve in the way of a deal in Kishinev, it seems, and told Bronstein he was going there to visit an uncle for a few days, by way of excuse.

Bronstein was not enthusiastic over this semblance of family devotion, for something seemed to tell him—the crystal seemed to say—that Blatzky was about to slip over something in which there would be a paucity of nourishment for Bronstein. The latter was torn between suspicions that Blatzky was going maybe to Odessa and trying to deceive him, or that he was really going to Kishinev. After pondering on the problem, the solution finally came to him and he cried out:

"You tell me, Blatzky, you are going to Kishinev, when you know in your heart I think you are going to Odessa, and all the time you are really going to Kishinev. Liar that you are!"

TIX.

Moscow, December, 1919.

WINGING IT WITH B. A.

CLEVELAND—Treading this Erie shore for only a few days one senses Cleveland's hopes, expectations, and even wagers, that she will become the "Fourth City," instead of a well-advertised "Sixth City." Probably by the time these lines appear in print, April 1, the result of the federal decennial census will be known. Our own guess, though we like Cleveland tremendously as a city, is that she will find herself fooled by the time of All Fools' Day, for we believe Detroit will be counted in as having a population lead over Cleveland by a margin of about 150,000 souls. Detroit will be the "Fourth City," ranking next to Philadelphia, and Cleveland will be the "Fifth City" on the list.

Our unofficial estimate of the population of Detroit, Cleveland's rival in the most spectacular intercity race of the 1920 census, is:

1,052,487 folks

We think Cleveland's population will be ascertained to be, as a result of a week's straw canvass we have made on our own:

902,487 folks

Maybe we are prejudiced, for we first saw the light of day in Detroit when it had a population of only about 150,000. We were delicately reared there, with the aid of a slipper and a switch, and there still be relatives in that town who will tell you, if pressed, that it is too bad a railroad switch wasn't employed in the "raising" process.

But we are in Cleveland—and we may leave the topic of Detroit, and our admiring family there, until next week. The Clevelanders swear they have more than 900,000 population, which reminds one of what old Moses Cleaveland, who founded the original village, is quoted as having written on the subject in the year 1800:

"Under reasonable conditions Cleaveland might some day become as large a place as Windham, Connecticut."

This Moses, who took his children and fellow real estate speculators into the wilderness, in order to *cleave* to the *land*, we suppose, did not overestimate. Cleveland, since dropping one of its "a's," has developed into one whale of a fine, upstanding city, and now boasts a dozen large suburbs, each of which is larger than Windham. The Way-Down-East Yankees that bought land in what was called the "Western Reserve" at 40 cents an acre, had a deal of perspicacity. Some of their descendants are still cleaving like grim death to the original tracts of land, and it is worth a whole lot more now.

Cleveland needs badly one thing that Detroit has, and that is adequate railway terminal facilities for passengers and freight, with a decent, modern station. The town is by no means asleep on the subject, of course, and a big terminal project is under way. All the roads, including the New York Central, Lake Shore, Big Four and the Erie, have gotten together on the proposal for a fine station in the heart of the business section, the only hold-out, as the sporting writers say, being the Pennsylvania. The Pennsy is a bit uppish on the proposition, favoring a different site on the lake front. But Cleveland will get its Union Station.

* * *

This town is headquarters for a big subscription bureau for popular magazines which handles 3,000,000 subscriptions a year. We talked to one of its wide-awake young managers, who told us that prohibition was having a tremendous effect on the periodical publishing business. Don't laugh, please; we know that almost every unusual trend these days is credited to prohibition. But our informant told us:

"Our canvassers in homes, offices and factories everywhere report that in families where indulgence in liquor was the rule formerly, that much more reading matter is now bought. Men who used to spend their evenings in saloons now stay at home and read the magazines. Women who were wives of drinking men, or who themselves were addicted to alcoholic exhilaration, now are trying to beautify their homes more and aid their sons and daughters to improve their condition, and they are turning to the women's periodicals for suggestions and help. They have more money to spend for worth-while things.

"These are facts and our business is mounting rapidly. Our company is taking in millions of dollars for current literature since liquor was eliminated. People think differently, see things differently. People either go forward or they retrogress—they better their opportunities when without liquor, and they reach out for mental stimulus and entertainment."

We know now why so many thousands of people are reading *Buenos Aires* every month!

DETROIT—Well, here we are in the old Home Town. So this is Detroit! It has become S-O-M-E *ciudad* since that day nineteen years ago this spring when we blithely sallied forth into the world on our own to see and learn more of it. Various continents, archipelagos and climes have witnessed our adventures since that day, but we have never discovered but one city that could swerve any part of our enduring admiration and loyalty from Detroit, and that is the little old "Wonder City" down by the Statue of Liberty. Most folk have to live in New York a considerable period, and know and understand her by becoming anchored and temperamentally acclimated, before they can have a real affection for the big town and its traditions. It is too complex, too overwhelming, to be taken to the stranger's heart all at once.

Detroit, though it has leaped in the last fifteen years into the front rank of American cities, has really never lost its essential flavor. It has lost in spots some of its small-town good looks, but has taken on a degree of metropolitan stateliness and beauty. Long before it became the "Automobile Capital" of the world—this one city makes many more cars than all the countries outside the United States put together—Detroit was the premier city of the world in the manufacture of stoves and drugs. They really do make other things in Detroit besides automobiles; we know, because we have ridden in them. The City of the Straits is a world manufacturing leader in a dozen lines. Many folk believe that its present ratio of growth will continue and that by 1930 it will have passed even Philadelphia and be exceeded only by New York and Chicago in population. This, however, may be expecting too much.

About the only things one finds unchanged are its old City Hall and the Soldiers and Sailors' Monument in the *Campus Martius*. The old *Free Press*, "M. G. N." is still on the job, with Eddie Guest whacking out his column of fun, verses and philosophy every day. On the staff we find some of our one-time associates of cub reporter days, 23 years ago. Twenty-three years! But stop, we aren't a day older than we were then.

Detroit has always been famous for its pretty girls, avenues and parks, and we are pleased to report that it hasn't slumped off any. *F. J. T.*

We are indebted to an English jester for the following dialogue, related as having taken place at a seance:

'Arry was dead, and 'Arriet, his widow, was holding converse with him through a medium.

"Are you 'appy, 'Arry?" she asked.

"I'm very 'appy," he replied.

"Are you 'appier than you were 'ere with me, 'Arry?"

"Yes—much 'appier, 'Arriet."

"And 'ow do you like it up in 'eaven, 'Arry?"

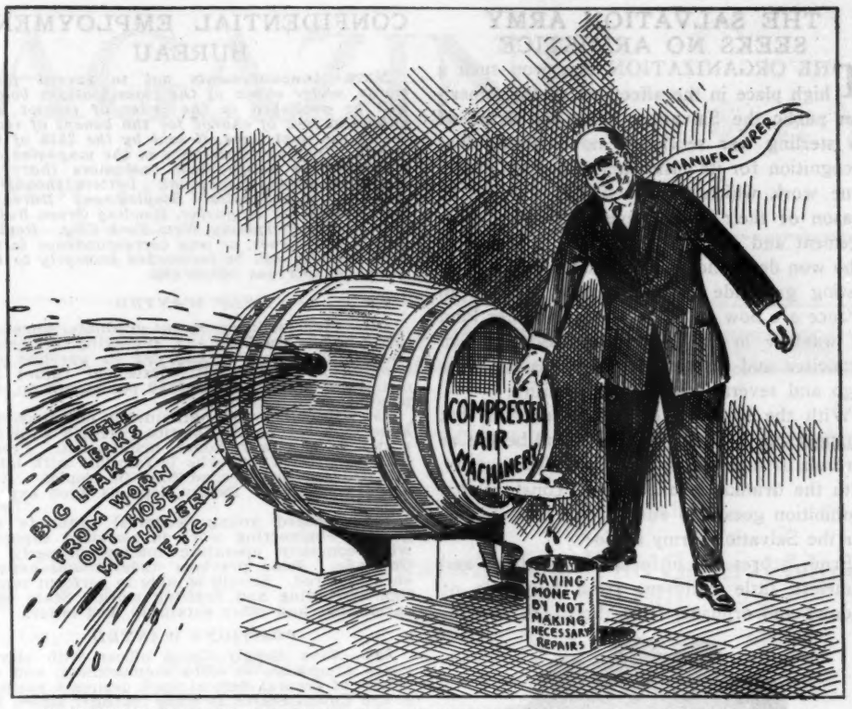
"I ain't in 'eaven, 'Arriet, I'm in 'ell.

MYTHS OF THE MINES

Underground workers in coal and other mines are full of superstititons, some of which are extremely weird says a writer in the *Kansas City Star*. Darkness means mystery, and imagination has created various hobgoblins that are commonly believed to lurk in such places.

For instance, there is the "ladder dwarf," a hunchbacked demon with a large head and enormously long and powerful arms. His favorite trick is to climb the ladders in mines, and, as he passes the rungs, to kick them out one by one.

In Germany mines are haunted by two supernatural beings called Nickel and Kobold—the former being benevolently disposed, the latter evilly mischievous. They are the gnomes who fill or empty the lodes. Nickel, if properly propitiated, will reproduce metal-bearing ores as fast as they are removed.



SAVING PENNIES ON REPAIRS—WASTING DOLLARS IN AIR LEAKAGE

Kobold, on the other hand, will steal away the metal from the lodes. He blows out the miners' lamps and if he catches a man alone he may drag him about by the hair. If he has a special grouch against an individual miner he will throw him down a ladder or crush him beneath a downfall of rock.

To gain the good-will of these formidable goblins, some miners leave bread, cakes and even money in odd places. And as a special means of appeasing them, two metals, nickel and cobalt, have been named after them.

AIR TRAFFIC CONVENTION

France and Great Britain signed a provisional agreement with Switzerland concerning air traffic in a convention of representatives of the powers. The agreement came into force March 1. Each country agrees to grant free passage over its territories and territorial waters during peace time to registered air craft which comply with the conditions of the convention.

Air machines must not carry wireless without special licenses from their States, according to the agreement, and must cross frontiers only at certain points which are to be specified. Each of the States will name one or more airdromes on its territory which must be used for the arrival and departure of machines.

COMPRESSED AIR MAY RUN AUTOS IN NEAR FUTURE

By C. H. CLAUDY

[In *Motor Life Magazine*]

What with Fiume and the pope leaving the Vatican for a ramble around Rome, and the success of the Italian arms and everything, Italy has decided that the only real power to fit a free nation is free power. Hence the Italian inventor has produced a scheme by which vehicles of wheels and carriages and springs and things are to be propelled by air, which is just as free in Italy as it is anywhere else.

According to the accounts, the scheme is to have huge tanks by the wayside holding vast quantities of compressed air. Locomotives and automobiles and tractors and motorcycles and probably bambinoettes (the present scribe doesn't know any too much Italian, but that sounds as if it ought to be Latin for baby carriage) can run alongside and connect their tanks to the mother tank, get a lot of compressed air on board and run to the next stop without any carburetor trouble, expensive and smelly smoke, oil consumption, electric system, cooling system or anything else except a piston and a cylinder.

The French Chamber of Deputies has passed the Daylight Saving bill and the measure has been sent to the Senate for action. Because of the coal shortage, the bill provides that in this year and in 1921 the Summer time period shall be a month earlier. Hitherto Summer time dates have been fixed arbitrarily, there being no law on the subject.

The mammoth Wakulla Spring in Florida is 400 feet across, is 80 feet deep and flows at the rate of 120,000 gallons per minute. It gives rise to a river 250 feet wide at its source. It is situated about fifteen miles from Tallahassee.

Chapultepee Military Academy, known as the "Mexican West Point," was re-opened as the leading feature of the recent celebration of the national holiday. The school has been closed for the past five years.

THE SALVATION ARMY SEEKS NO ARMISTICE

THE ORGANIZATION that won such a high place in the affections of the American public the Salvation Army by virtue of its sterling war service is now gaining that recognition for its customary and usual peace-time work which these activities deserve by reason of their extensiveness, effective management and great public value. The lassies who won decorations and the doughboys' everlasting gratitude by their heroic service in France are now helping to wage another kind of warfare in New York and Boston, San Francisco and Seattle, New Orleans and Chicago and several hundred other cities.

With the so-called down-and-outer all but disappearing from the highways and hedges as a result of high wages and general prosperity, with the drunkard vanishing as constitutional prohibition goes into effect, what is there left for the Salvation Army to do?

From scores of unfortunate mothers and nameless little children, from hundreds of widows and orphans, from thousands of con-

victs in prison cells, from tens of thousands of the homeless and friendless and from countless hordes of America's sick, crippled, unfortunate and misfit men, women and children, comes the answer, strong, clear, unmistakable:

"Care for us!"

And the Army itself is as thoroughly equipped for its peace-time labors as it was for war-time work. Perhaps there is some compensation for being numbered amongst the very poor, for they only know the Salvation Army in all its far-flung human service.

Then there is the problem of the man of sixty or more. Perhaps his wife is dead, his home is gone and his children do not see their way to take him in. Or perhaps he is entirely friendless and has no place to pass the evening of his life. There is the Salvation Army industrial home where he may go, find easy, congenial work and a home and not feel that his is a charity case.

The instances of Salvation Army service might be multiplied indefinitely. From the morning to the evening of life there is no misfortune, no dark hour, but the Salvation Army stands ready with the helping hand, the simple, understanding service. Convicts, widows, orphans, the poverty-stricken, the sick and the well of many kinds and races by tens of thousands call the organization blessed.

Such is the Salvation Army in peace-time.

CONFIDENTIAL EMPLOYMENT BUREAU

NOTE—Announcements not to exceed forty words, under either of the classifications below, will be published in the order of receipt and published free of charge for the benefit of readers in the next issue, if sent by the 25th of the month. Display advertisers in the magazine are privileged to notify their customers that this service is at their disposal. Letters should be directed, "Confidential Employment Bureau," Compressed Air Magazine, Bowling Green Building, No. 11, Broadway, New York City. Replies to advertisements, or any correspondence in regard thereto, will be forwarded promptly to the person or persons concerned.

HELP WANTED

450—Civil engineer, recent graduate, some experience in drafting and surveying preferred, wanted by company engaged in gasoline extraction at Taft, Calif. Excellent future for competent man. Salary $150 per month up, depending upon experience.

451—Machinery manufacturing company desires man for South American service with experience in power house installation. Prefer man unmarried and who is familiar with labor and transportation conditions in tropics. References required. Salary depends upon experience.

452—Wanted young technical graduate for general engineering work in assistant capacity with company operating mining property in Colorado. Some previous underground experience required. Should be able to perform sampling, surveying and drafting work. State education, age and other details in first letter.

POSITIONS WANTED

890—Navy Supply Corps officer with eleven years experience in office management, and all phases of general clerical work desires a position in the United States as office manager where his experience will be of value to a large concern.

891—Man thoroughly familiar with penumatic tool practice, having extensive experience in manufacturing, repairing and assembling, wants position as supervisor of pneumatic tool repairs. At present employed in large plant. Full in formation and references in first letter.

892—Man would like position in charge of diamond drilling in Canada. Has thorough experience with mechanical operation and making repairs. Familiar with steam or gas engine for power. Best references from employers in last ten years.

893—Technical graduate and experienced engineer would like position on part time on construction work particularly erection of small buildings. Will make designs, blue prints, etc.

894—Officeman, stenographer, correspondent, 30, single, ten years mining, construction, motor experience, no vices, seeks connection with mining industry as secretary to executive, now employed similar capacity. Excellent credentials.

T. M. Owen has returned from Australia after an absence of seven months. He has been appointed assistant general manager for the Federal Mining & Smelting Co., Wallace, Idaho.

Latest U. S. Patents

Full printed uncertified copies of specifications and drawings of any patent may be obtained by sending ten cents (not stamps) to the Commissioner of Patents, Washington, D. C.

FEBRUARY 3

1,329,354. COMBINATION AIR-VALVE AND PRIMER FOR INTERNAL-COMBUSTION ENGINES. Gustav E. Anderson, South Bend, Ind.

1,329,390. AIRPLANE-BRAKE. Augustus S. Flack, Los Angeles, Calif.

1,329,480. TURBO-COMPRESSOR MOUNTING. Earl H. Sherbondy, Cleveland, Ohio.

1,329,618. MEANS FOR DELIVERING AIR-PUMP AND BLOWER EXHAUST TO LOCOMOTIVE-SMOKESTACKS. Abram N. Lucas, Milwaukee, Wis.

1,329,620. BELT-PULLEY FOR POWER TRANSMISSION. William Joseph Manning, Wolverhampton, England.

1,329,689. POWER-DRILL. Martin R. Wood, Huntington, W. Va.

1,329,853. MANUFACTURE OF GAS. Walter F. Rittman, Pittsburgh, Pa., assignor to Synthetic Hydrocarbon Company, Pittsburgh, Pa.

1,329,876. AUTOMATIC TIRE-PUMP. Henry J. Appleton, Detroit, Mich.

1,329,882. FLOODED AMMONIA-CONDENSER. William L. Bodine and Charles R. Solomon, Springfield, Mo., assignors to United Iron Works Company, Springfield, Mo.

1,330,759. PRESSURE-GAGE AND PUMP CONNECTION. William P. Hammond, Passaic, N. J., assignor to A. Schrader's Son, Incorporated, Brooklyn, N. Y.

FEBRUARY 10

1,330,097. GLASS APPARATUS. William E. Sloppy, Mount Jewett, Pa.

1. In an apparatus of the class described, the combination with a movable frame and tube, an air compressor and motor therefor carried by the frame, and a pipe for supplying air from the compressor to the tube; of a cylinder in the frame communicating with said tube, a piston therein raised by increase of pressure, a stem rising from the piston, means for supplying motive fluid to said motor, a control for said means actuated automatically by the rise and fall of said stem, and a finger in the frame manually adjustable into the path of said stem to check the action of said control.

1,330,171. PERCUSSION-DRILL. Alberic Louis Chopin, Paris, France.

1,330,238. METHOD OF AND APPARATUS FOR DRYING, CONDITIONING, AND REGULATING THE MOISTURE CONTENT OF HYGROSCOPIC MATERIALS. Willis H. Carrier, Buffalo, N. Y., assignor to Buffalo Forge Co., Buffalo, N. Y.

1,330,266. PUMP. Michael B. Holstein, Richland, Pa.

1,330,296. AUTOMATIC AIR AND WATER PROPELLER. Albert A. Ake, Kansas City, Mo.

1,330,466. PRESSURE-GAGE. Charles Ballard Hale, Park Ridge, Ill., assignor to Time-Systems Co., Detroit, Mich., a Corporation of Michigan.

1,330,527. AIR-SPRING. Lucien R. Gruss, San Francisco, Calif., assignor to Pneumatic Cushion Company, San Francisco, Calif.

1,330,707. AUTOMATIC GLASS-BLOWING MACHINE. Frank B. Hoffstetter, Warren, and Francis J. Rippl, Cleveland, Ohio, assignors to General Electric Company, a Corporation of New York.

FEBRUARY 17

1,331,209. AIR-COMPRESSOR. Gordon Phillips, Cobalt, Ontario, Canada.

1,331,283. AIR-BLOWING FITTING WITH INTERNAL CLEANING-WIRE. Thomas Shipley, York, Pa.

1,331,371. PAINT-SPRAYER. Orla R. Plummer, Napoleon, Ohio.

1,331,473. AIR-SUPPLYING APPARATUS. Harlo M. Herring, Marshall, Minn.

FEBRUARY 24

1,332,051. PNEUMATIC AND OTHER POWER HAND-MACHINE SUSPENDER. Thomas Malcolm, Scotstoun, Scotland.

1,332,105. DRILL-BIT. Frank L. Clements, Jr., Houston, Tex.

1,332,188. CONDENSER. Raymond N. Ehrhardt, Edgewood Park, Pa., and Harold M. Graham, St. Johns, Quebec, Canada, assignors to Westinghouse Electric & Manufacturing Co.

Index to Advertisers